The 'Typical' Network User

By Ronald A. Frank

Of the CW Staff

NEWTON, Mass. – The "typical" network user operates a regional data communications net including a mix of CRTs, remote batch and interactive terminals and utilizes either dial-up or private lines.

The lines usually come from the telephone company and the hardware – including modems, CPU and terminals – is supplied by about four different vendors. The transmission speed of the network is probably 1,200-, 2,400- or 4,800 bit/sec and the biggest problem is maintaining line quality.

This is a snapshot of the 128 network users who responded to the recent *Computerworld* network survey [CW, Nov. 5]. Applications ranged all the way from small companies configuring their first network with one remote batch terminal to operators of international time-sharing nets.

Communications is definitely a multivendor domain, the survey found; eight users said they have 10 or more different suppliers. Twenty-one said they are being served by four vendors for their equipment, and another 21 said they have two vendors, which probably includes both a hardware supplier and a carrier.

Twenty-one users said they utilize specialized common carriers in their net and most of these also have telephone facilities. Some of these phone company lines are probably used for local loops. The majority rely on the phone company, with 99 having only one carrier. Surprisingly, Western Union was classified as a specialized carrier by about six users.

The most popular transmission speed appears to be 4,800 bit/sec (43 users) with 2,400 bit/sec running a close second (38 users). Twenty-eight users said they operate at 1,200 bit/sec while only 18 said they use 9,600 bit/sec.

(Continued on Page 4)

CW Special Report on "Unraveling Data Networks" follows Page 22.

COMPUTERWORLD

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Turmoil Touches IBM

Even IBM has been touched by the current political turmoil in Portugal. See story on Page 5.

Concerned About Security

Law Officials Balk at DP Sharing

By Nancy French

Of the CW Staff

WASHINGTON, D.C. – Law Enforcement officials expressed the concern here last week that shared rather than dedicated computer systems might pose security and service problems.

Testifying at hearings conducted by the Law Enforcement Assistance Administration (LEAA), Adam D'Allessandro, deputy director of New York State's division of criminal justice services, said computer people have assured him they can provide a system secure from penetration by unauthorized persons.

But such shared systems must be looked at "with a jaundiced eye," he said.

D'Allessandro acknowledged, however, that economic considerations left many law enforcement agencies little choice but to share. In such cases, according to D'Allessandro, "control" over the entire system should remain with law enforcement officials.

The hearings were held to give law enforcement officials and the public an opportunity to comment on the proposed rule change amending the requirements for dedicated computers for criminal justice information systems [CW, Oct. 29].

At the time the rule was amended to permit shared secure systems, Justice Department officials said they had "reevaluated" the dedicated requirement and found costs would be excessive.

Although two days were allocated for hearings here, so few testified that the hearings were wrapped up in one day. Additional testimony will be heard in Atlanta Nov. 21 and in San Francisco on Dec. 4.

The panel hearing testimony included LEAA administrator, Richard W. Velde; LEAA general counsel, Thomas Madden; and Dolan and Andrew Decker, both of the Federal Bureau of Investigation (FBI).

24-Hour-a-Day Job

"The law enforcement function demands a 24-hour-a-day, 7-day-a-week service for communications and information retrieval. These services are the 'lifeblood' of day-to-day law enforcement operations and responsibility for their cost-effectiveness must not be delegated in whole or in part," said Lieut. O.S. Neely.

Neely represented Search Group, Inc., a nonprofit corporation and successor organization to Project Search, established by LEAA in 1969 to study DP technology in criminal justice systems.

Neely emphasized that more rather than fewer rules are needed "in the absence of national" laws.

Further, rules are needed promptly to help states complete planning for implementation of a new section of the Safe Streets Act due March 16.

"Minimum standards for maintenance and use of intelligence files and sealing of the purging files also should be included in the regulation," he said.

In addition, provisions should be included that set limits on the use of arrest records without dis-

(Continued on Page 4)

Politics Blamed as N.H. DP Head Quits

By Ronald A. Frank

Of the CW Staff

CONCORD, N.H. – A behind-the-scenes political fight for control of the New Hampshire Department of Centralized Data Processing (CDP) has led to the resignation of its director, Arthur T. Hill.

Because of continued clashes between Hill and some members of the state CDP commission, including chairman Edward Berg, Hill resigned effective Jan. 1.

In his letter of resignation to the commission, Hill referred to a two-year "personal conflict" with Berg. This situation made it impossible for him "to concentrate fully on the functions of my office" and, as a result, "the taxpayers of New Hampshire were being short changed," Hill wrote.

But Berg said "I am not political. I am trying to do the job and see to it that CDP is giving the citizens of New Hampshire the maximum return on their investment.

"I think it was a great day for the citizens of New Hampshire when Hill resigned," he added.

The conflict in New Hampshire is the result of the creation of a central DP agency set up to service the computing needs of all state departments. Gov. Meldrim Thomson has increasingly attempted to get the CDP commission involved with the priority scheduling of programs and other internal matters, according to state sources, and this attempt at control has increased as more Thomson appointees have been named to the CDP commission.

The issue is one of accountability of the CDP director. According to state law, the CDP commission is to have the "same powers of management, supervision and direction" over the CDP department "as the directors of a business corporation."

At the same time, the CDP director is to be appointed by the commission to "organize, establish and operate the department and employ necessary personnel."

After Hill resigned, Thomson issued a statement claiming the CDP operation has cost the taxpayers millions of dollars. "There has been a great reluctance on the part of CDP officials to cooperate with the heads of other agencies," Thomson said.

(Continued on Page 4)

Mini-Controlled Trains Idle at Giant Texas Airport

By Patrick Ward

Of the CW Staff

FORT WORTH, Texas – Automated trains no longer trundle around the giant Dallas/Fort Worth Airport here.

The computer-controlled "Airtrans" system [CW, July 3, 1974] has been idle since March, when its builder, LTV Aerospace Corp., stopped work in a contract squabble with the airport board and eight airlines.

The airport and airlines have sued LTV for $200 million in punitive damages. LTV in turn is countersuing them for $700 million in damages "due to loss of image and potential sales," according to an LTV spokesman.

"It's rather a tragic situation," the LTV spokesman remarked.

The airport and LTV signed a $34 million contract in 1971 for the Airtrans system, which carried passengers, luggage, mail and trash around the "World's Largest Airport."

Six minicomputers, rather than on-board trainmen, controlled the rubber-tired trains. The cars have hard-wired logic units which communicated through a

(Continued on Page 4)

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After Six Months in Court

Legal Maneuvering Marks IBM Trial

By Edith Holmes
Of the CW Staff

NEW YORK – It's been more than six months since U.S. vs. IBM opened here on May 19 – and two months since the Federal District Court reconvened following a two-month recess to permit further discovery and additional depositions in the government's antitrust action against the corporation.

When the trial resumed on Sept. 22, the parties had agreed to incorporate the bulk of the Telex record in the evidence of this case, the government had subpoenaed documents from Xerox Corp. to determine why that company had decided to leave the computer industry and observers had hopes the case would progress more quickly than it had during the spring and early summer.

But legal maneuvering – rather than the question of IBM's intent and ability to monopolize the systems business in the computer industry – continues to characterize this trial.

The Department of Justice is still in the market definition portion of the government's case and will be for some 10 more witnesses or so.

The government has made it through eight other witnesses, part of the testimony of a ninth and has added the deposition of Ray W. Macdonald of Burroughs Corp. to the several depositions read into the record last spring and summer. Thus, by the end of the 15th week of trial last week, Justice had presented and completed the testimony of 15 witnesses from its list naming over 100 people who will come before the court on behalf of the government in this case.

Certainly, the length of time witnesses have spent on the stand depends as much on cross-examination as it does on direct questioning. Cross-examination has always been at least as long as the government's direct and sometimes takes twice as much time.

Spending eight days on the stand, over half of them on cross-examination, Clarence W. Spangle of Honeywell provides perhaps the best example of this.

Some contend the defense is trying to prove its direct case on cross; others argue IBM is telling government witnesses that when they come to New York to testify. No matter how important or busy they are – they had better be prepared to stay awhile.

Spangle made numerous shuttle trips between his corporation's headquarters in Minneapolis and the trial in New York during the course of his testimony, and William C. Norris of Control Data Corp. sat patiently through the last two days of Spangle's testimony, waiting to take his turn on the stand.

Diversion From Charges

These kinds of tactics in the courtroom and actions relating to the procedures the judge hearing the case has employed in this trial have served to divert attention from the charges of monopoly against IBM.

Analysis

The news fit to print concerning U.S. vs. IBM lately has centered around the decision by the Second Circuit Court of Appeals to grant IBM's petition for a writ of mandamus [CW, Nov. 12]. The issue of whether Judge David N. Edelstein, the sole arbiter in the case, had overstepped his procedural bounds lasted for some three weeks, from the time IBM first filed its petition asking that certain of Edelstein's orders be vacated until the appeals court rendered its decision. And during that time period, the mandamus action dominated all news accounts of the suit.

Very little has been said in open court regarding IBM's appeal to the Second Circuit, but there continues to be considerable speculation going on in the courtroom and among those concerned with the outcome of the case on how this public "dressing down" of Edelstein and the Department of Justice will affect the trial in the long run. In general, the belief is that the "long run" will be longer.

A second issue peripheral to the charges brought by the government against IBM and now at trial is IBM's request that the "gag rule" – Pretrial Order 4 – be removed. Both parties now declare the rule – an order IBM originally asked for and one to which the government has assented since it was adopted in this case in 1972 – unconstitutional.

The judge has yet to rule on this request by the parties. At this point, if the gag rule is lifted, IBM could launch a massive advertising campaign to influence public opinion.

The corporation's counsel has already argued it is only fitting for IBM to be able to publicly answer critical comments made against it in the press and particularly by the Computer Industry Association, allegedly on behalf of the government.

To a large extent, however, the fact the substantive issues of monopoly and intent to monopolize have not been more dominant in the tone of the trial or in its record of now nearly 8,000 pages is also a result of what is going on in the courtroom. The testimony of the witnesses that have taken the stand seems to have left much to be desired in the way of proving the government's points.

There is some speculation the government is saving its big guns – both in terms of witnesses and documents – until later; but others argue if the Department of Justice can't prove market definition aspects of its case, it won't be able to prove anything else it has charged.

The heart of the case has been exposed fleetingly in the course of the past two months of trial. In these instances, some of the problems the government may have unavoidably encountered in its efforts to prove its charges against IBM have been illustrated.

The first occasion occurred when Honeywell's Spangle was asked whether there are tactics IBM could use to force his company out of the computer business [CW, Oct. 8]. A second instance was when John J. Hangen refused to give some NCR Corp. documents to the defense counsel for fear IBM might gain a look at NCR plans for the next five years [CW, Nov. 19].

In proving intent to monopolize, the government needs to have its witnesses say they fear IBM actions in the marketplace. But – keeping their investors, stockholders and creditors in mind – few of these industry witnesses are likely to feel very comfortable saying "Yes, IBM could force us out of the market."

It is important to remember the government does not plan to try to prove IBM has done anything illegal, but that the corporation does monopolize and has taken actions showing its intent to monopolize the computer systems market. There are likely to be several more instances in which the Justice Department will have trouble proving intent.

Tension and Hostility

One last effect of the last two months of trial has been an increased tension and hostility between the parties in the case. Particularly during the events leading up to and surrounding the mandamus decision in the Second Circuit, relationships appeared strained.

At one point, IBM's lead attorney suggested the parties will never return to the appropriate level of amenities in this case – that what they must do now is concentrate on the substance of it.

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CW Special Report on 'Unraveling Data Networks' Follows Page 22

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N.H. DP Head Quits Post; Politics Cited

(Continued from Page 1)

Countering the governor's claim of mismanagement, Hill cited figures showing CDP is now serving 16 state agencies and running 225 jobs on a regular basis that produce 525 scheduled printouts.

A total of 16,000 job/year are being processed by CDP, Hill said, and the books are being closed on time.

"The governor is either uninformed or ill-informed," Hill said, adding the state controller's office recently sent a letter to the governor taking credit for issuing that office's annual report early.

That happened because the entire document was printed out on the CDP Honeywell 6060 system, but no mention or credit was given to the CDP role in the project, Hill said.

Problem of Priorities

Typically state agency heads expect CDP to serve them without any problems, Hill said, but one problem which has developed is that a schedule of priorities has to be established to determine in what order agency jobs will be run.

The New Hampshire Legislature addressed the priority problem in June of this year and established a special committee to work with CDP on this function. But the committee has never met and its members have yet to be appointed by the governor, Hill said.

On hearing of Hill's resignation, George Roberts, speaker of the House, said "incompetent appointments by Thomson [to the CDP commission] are forcing responsible people" to leave state government.

Roberts, a former member of the commission who was not reappointed by Thomson, called for an investigation of the operations of Berg as CDP chairman.

No Rush to Judgment

CONCORD, N.H. – The New Hampshire Centralized Data Processing (CDP) commission has not met since September, despite the resignation of Arthur Hill, director of the state CDP department.

One commission member, John Chapman, attempted to call a meeting on Nov. 14 when Hill resigned, but the session was never held.

Gov. Meldrim Thomson said he could understand why Chapman was "miffed when I thwarted his attempts to call a rump meeting of the commission."

At least one other commissioner, Thomas Byrne, has called for a meeting to discuss the resignation and begin the search for Hill's successor. The commission chairman, Edward Berg, said he expects to set a meeting for the day before Thanksgiving if a quorum can be convened.

By law only the commission has the power to select and hire a new director of the CDP department.

Law Officials Cite Security as Sharing Concern

(Continued from Page 1)

positions. Federal rules also should contain provisions delineating what role the FBI or other federal agencies may play in the national computerized criminal history system, he said.

As for use of arrest records tor employment within the criminal justice community, Neely recommended that sealed as well as unsealed records be made available for this purpose.

Index of State Records

In the areas of the National Crime Information Center's computerized criminal history system, Neely recommended there be "no storage at the federal level of records related to state offenses unless the offender has a record of violations in two or more states."

Reiterating Search Group's original recommendation, he said the federal role should be limited to providing an index of records stored at the state level. Exceptions to this multistate single-state system could be permitted for "a reasonable" period pending completion of systems in states that otherwise would be unable to participate.

Howard M. Livingston, director of the North Carolina Police Information Network (PIN), stressed the need for criminal justice agencies to "set the priorities for use of the system's equipment and personnel" or there will be "no guarantee" that records in the system would be accurate and responsibility disseminated.

Anthony McCann, speaking for the National Association of Counties, supported the rule change saying dedication would not only have been expensive, but in reality did not address the basic danger to individual privacy.

"The greatest danger for abuse is not that files will be electronically linked to create a 'dossier' or that an unauthorized user will be able to activate a terminal to access data: The greatest danger for abuse is the unauthorized use of data by authorized users," he said.

"This must be dealt with by proper software control and rigorous enforcement procedures."

McCann added that the counties' only specific concern "with the new rules is the requirement that the administering agency be a 'criminal justice agency.'

"We believe that the chief elected state or local official under whose jurisdiction the information system operates should be charged with naming the responsible agency.

"The agency so identified must have policy and personnel control over the operation of the criminal justice information system and thereby clarify the issue," he said.

Ruffin Blaylock, director of the Alabama Criminal Justice Information Agency, also agreed with the change based on cost and the fact that "state-of-the-art technology . . . permits protection without dedication."

He also agreed with McCann's contention that privacy and security legislation should be directed toward people in the system rather than toward the tools they use.

He "respectfully" suggested that, when considering further regulations, LEAA and the Justice Department should "involve all members of the criminal justice community. We do not want another Oregon situation at the national level [CW, Oct. 1]," he said.

Survey Profiles Typical Net User

(Continued from Page 1)

Multiplexers are more popular (30 users) than concentrators (17 users) and most users have several of these units once they include them in their nets. Regional networks seem to be more numerous, numbering 64, than national nets at 40 and four users described their networks as international.

The use of dial-up and private lines is almost equally divided at 40 vs. 43 users, with several users having both types of lines.

The biggest problem area in a network is line quality, 29 respondents complained. Eight said telephone personnel cause problems; seven said multivendor disputes give them headaches.

Ten said they have hardware problems while five said their software is a problem area. Six said they are bothered by transmission errors and five said fault isolation needs improvement. Six users said they have no network problems.

CRTs appear to be the most popular type of terminal with 87 users while 59 said they have remote batch terminals. Close behind are interactive terminals with 55. Only 32 said they are operating intelligent terminals in their network.

Almost all users said they are planning some type of expansion or upgrade, but many said the changes are still in the planning stage. Many of these said they wanted to switch to faster hardware.

Almost all users said they run multiple applications on their networks, apparently to justify the cost of operating them. Inventory and accounting were two of the most mentioned applications and, in some cases, these run side-by-side with transaction-oriented uses like nursing station data and point-of-sale information.

Almost all nets are oriented to terminal-to-CPU traffic with only one user saying he plans to implement a CPU-to-CPU upgrade, the survey found.

Mini-Controlled Trains Idled

(Continued from Page 1)

signal rail with the human supervisors at the Airtrans central control console.

The minicomputer systems directed the vehicles and provided reports on the status of each train to the console operator.

'Nervous' Software

However, the train's safety software tended to be "nervous," in the words of an LTV spokesman, and sometimes brought trains to a stop in the middle of nowhere.

The software-controlled audio system that announced forthcoming stations didn't always perform reliably either, airport authorities said.

Modifications to correct these and other difficulties limited the number of Airtrans cars available for service, an airport spokesman said.

Both software bugs and loose wires could halt the trains, an LTV spokesman explained. Mechanical problems with the tape drives, not software bugs, caused the difficulties with recorded announcements, he added.

Overall, the computer control approach "worked out very well. We have been quite pleased with its performance and the way we designed it," the LTV spokesman said.

The airlines and the airport charged LTV wrongfully discontinued work on Airtrans after the airport refused acceptance on the system and proposed several changes.

LTV countered that the airport's refusal came after Airtrans had been in daily use for over a year. In that time, the system had transported over three million passengers and logged over 3.5 million miles, LTV said.

This operating experience "had fully demonstrated [both] the ability of Airtrans to meet the design requirements and the fitness of the system for every purpose intended by the contract," LTV said.

'Popular Power' Reigns

Portuguese Revolution Also Affects IBM's Workers

By Joseph Hanlon

Special to Computerworld

LISBON, Portugal – The "popular power" poster on the door shows IBM has not escaped Portugal's revolution.

This view is soon reinforced for the visitor by the list of salaries for all 500 IBM workers posted near the lobby.

Like other companies in Portugal, IBM has an elected workers committee. In negotiations with management, it has already won a cafeteria, official IBM employment with benefits and higher salaries for 30 low-paid subcontract employees and permanent employment for 25 students on short contracts.

Despite management opposition, the workers committee held an international IBM workers meeting in Lisbon in July in an effort to set up an international IBM workers organization.

Fifteen people from six other European countries attended, and the government considered the meeting important enough for the Labor Secretary, Dr. Carlos Carvalhos, to give the opening speech.

Earlier this year, the committee did a study of IBM's commercial activities and concluded that, because there was no competition, the company had substantially oversold its biggest customer, the Portuguese government.

Thus, many government computers were underused, the report concluded, and IBM should stop selling more computers and instead help users to make better use of the ones they have.

Other workers committee projects included placing pressure on IBM to post salaries (management refused, but this year a law was passed which requires it) and working with workers committees at IBM user companies to suggest people who might replace DP managers sacked because of links to the previous government.

Nevertheless, IBM has been much less affected by the April 25, 1974 coup than many other multinationals in Portugal. In particular, the old management remains in charge, and the workers committee does not have the direct power over the running of the firm that other workers committees have.

Furthermore, the IBM workers are less outspoken and more worried about offending management than in other firms. This may reflect the high wages paid by IBM – the lowest is $250 per month, double the legal minimum. But the median salary is $900 per month – seven times the statutory minimum. And most IBM workers earn more than the $420 per month over which level no salary increases are permitted.

Indeed, many IBM workers are not happy with what they view as a relatively conservative workers committee. Eighty staff members this summer joined the IBM Committee to Support the Revolution and signed a declaration which was posted in the main lobby.

This unofficial group has been participating in the neighborhood council in the Alvalade area where IBM has its offices. It also has a group studying the role of information science in a socialist society. Another project is support for freedom of the press – collecting money for the *Republica* newspaper and demonstrating against the military occuption of the radio stations.

Finally, a number of members of the group have spent weekends working on farms in Alentego, where they are both doing physical labor and helping to organize the accounting systems of the newly formed worker-controlled farm cooperatives.

The first ad-hoc IBM workers committee was set up within a few weeks after the April 25 coup. It was elected by a general assembly of all IBM workers.

In July 1974, a formal workers committee was elected, with one representative from each of the 17 sectors in the company – office products, data processing, etc.

The next election took place this July for a revised workers committee. Instead of following the IBM divisional arrangement, the 17 people were elected to represent each professional group (secretaries, salespeople, systems analysts, etc.).

'Bad' Checks Undergo Recycling Into Dough

SAN JOSE, Calif. – At least two negotiable but improperly computer-coded Santa Clara County checks scheduled for destruction at a recycling plant were illegally recycled into money here recently.

Two county checks totaling $600 were cashed by unidentified persons; six checks have "turned up" altogether, according to William Meyer, head of Santa Clara's Office of Public Administrator and Public Guardian.

There also is a possibility that 660 or more checks may have passed into the wrong hands, Meyer indicated.

A total of 10,000 county checks intended for Meyer's department were incorrectly printed by a private firm.

The checks arrived at the Office of Public Administrator in "15 or so" sealed packets. When one of the packages was opened, employees discovered the checks were incorrectly numbered, rendering them useless, Meyer recalled.

"We had them under lock and key, waiting until we received a directive from the Finance Department, which eventually ordered the checks be destroyed by a private firm which handles the destruction of sensitive paper materials," he explained.

Complying with the directive, Meyer's assistants brought the checks to the firm, laid the packages on a conveyor belt and waited until most of the checks had dropped off the conveyor belt and into an acid solution.

Somebody at the recycling plant "must have grabbed a handful of checks" from the unsealed package before it dropped into the solution, he theorized.

The Sheriff's Department is conducting an investigation, but no suspects have been apprehended, he said.

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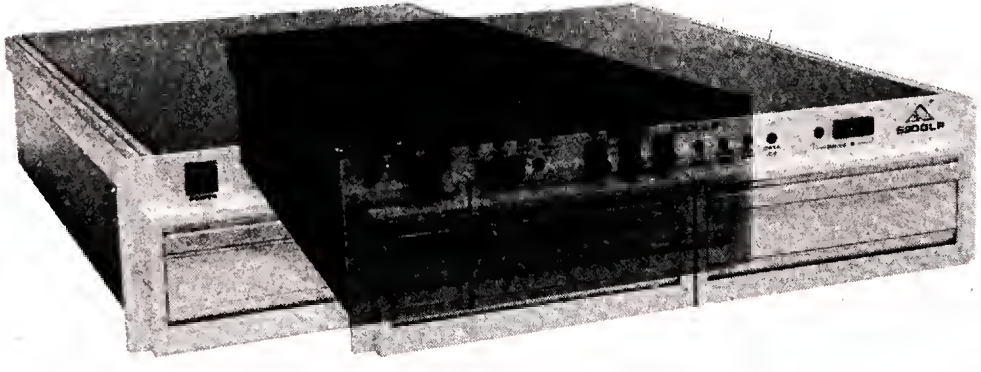

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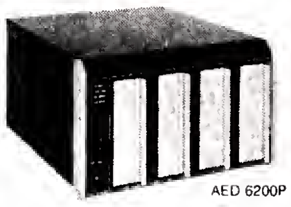

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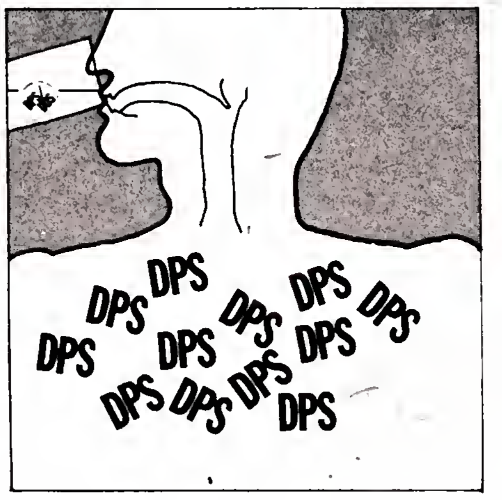

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This Year Alone

DP Crime to Cost Users Millions

By Toni Wiseman
Of the CW Staff

TORONTO – Espionage and theft involving computers will cost users of DP equipment millions of dollars this year alone, attendees at a recent conference here were told.

"Today's systems of both distributed and centralized data bases, multiprogramming, virtual machines and complex operating systems running in complicated data communications networks are wide open to the would-be spy," according to James F. Finch, president of DCF Systems of Canada.

"It would appear the majority of discovered cases are not publicized because they would tend to put the victimized company in a bad light," he said.

"It is estimated only 15% of all computer-related crime is ever reported. If this estimate is correct, then more than 500 acts will be committed in 1975, totaling many millions of dollars," Finch added.

Finch introduced his audience to what he termed "espionage and theft using computers" with some of the more famous cases, ranging from Equity Funding to the Cal Tech-McDonald's episode [CW, June 4].

He defined computer systems penetration as the act of unauthorized access to or control of data procedure and machine resources. This penetration, he said, could lead to observation, extraction, alteration, addition or utilization activities.

"The extent of system compromise may vary with type of penetration from accidental display of the contents of a file to complete loss of control by the operating system," he noted.

Sharing Abuses

The concept of ownership of data or programs in computers is often misunderstood, Finch said, noting that while data is owned by a user who only utilizes the system to store and process it, this data is often shared among users.

"It is misuse of the sharing privileges that causes difficulties and, combined with design flaws, permits penetration," Finch stated.

"Because terminals, communications lines and concentrators transmitting data are vulnerable to penetration, penetration becomes a greater threat as greater use is made of remote terminals and terminal networks," he said.

Finch outlined six major categories of penetration techniques:

- Browsing – of which searching a trash basket for log-on passwords or user identifications is the most basic form – often provides enough information to impersonate a legitimate user.
- A foible, or an accidental or unintentional opening that permits unauthorized access to information, can occur in either hardware or software, often because a programmer has inadvertently allowed an obscure condition to occur for which no check is made.
- An artifice is the intentional introduction of clandestine code into a system to be used later for subversion from within. It can be implanted at the time the system is implemented or during subsequent modification.
- An impersonation, or unauthorized activity carried out by masquerading as a legitimate user or device, is often used to subvert a computer system together with other penetration methods.
- Tapping is the gaining of access to a system via direct connection to a communications link or a part of the central system. Switching networks are particularly prone to this type of penetration, Finch said.
- Radiation, or passive eavesdropping without direct connection, siphons data from a system by detecting acoustic or electromagnetic signals emanating from a system or component, in particular communication lines and CRTs.

Finch suggested data encryption techniques as a possible method of thwarting would-be criminals. In particular, techniques should be used that require a thief to spend more money to break the system than he would spend to develop the information himself.

"As system protection mechanisms and procedures are improved, the penetration work factor necessary to gain access by technical methods could become so great that other methods, such as buying off an employee with access to the information, would be less expensive," Finch said.

The next best thing to penetration prevention is penetration detection, he stated. By using hardware and software monitors to track file and data base access by user and time, utilization profiles can be developed. Thus, if the monitor detects a deviation from profile, a security alert could be sounded, he said.

"An additional safeguard might be a security console displaying security messages. A systems security officer with the proper authority could, via the security console, monitor and if necessary limit file access or remote log-on," Finch said.

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Free Federal Matching Program Helps Commuters to 'Pool It'

Motorists in several cities and states are "pooling it" with a computer car-pool matching program available free of charge from the Federal Highway Administration (FHWA).

The advantages of car pooling are self-evident, according to Edward Fleischman of the FHWA. Presently, the average auto occupancy in the U.S. is 1.4 persons per car, he noted.

The cost of operating a car with only one occupant is $2.64, the highest cost per passenger of any mode of travel. However, a car with four occupants costs only 66 cents per passenger, he said.

Companies, too, can save with car pooling because it cuts their parking costs, Fleischman said. A multitiered inner-city parking facility can cost a company up to $909 per parking space, with suburban lots running up to $500 per parking space.

• Commuter Computer

In Los Angeles, an independent nonprofit corporation has been set up to administer a modified version of the FHWA program.

Commuter Computer presently involves about 1,000 companies and has a data base of 47,000 to 48,000 names.

But only about 10% of the people in the data base probably are participating in a car pool, a spokesman estimated.

The service is available in five counties surrounding Los Angeles, and the programming is done by the city's DP center.

The matching process is based on a grid system overlaid on an urban area map to which home and work locations are manually coded. A file of participants in the program is constructed, and participants are matched if they live and work in the same areas and arrive and depart within a specific range of time.

The State of Tennessee Department of Highways, the first user of the FHWA program, currently has a data base of 5,000 people. The service is available to the 15,000 employees of the state government in Nashville.

The Nashville program received a great deal of publicity at the outset, including a news feature on CBS-TV, which spurred a lot of initial interest, according to James Stewart, director of management systems for the department.

There is no ongoing campaign to recruit additional members because all the reserved parking available to program users is currently in use.

The program is run on the department's IBM 370/155, and "it is very easy to use," Stewart said.

The cost of setting up the system was 15 cents to 20 cents per person, he said.

The City of Dallas Department of Traffic Control started using the car-pooling program in January 1974, Sue Haynes of that agency said.

It is available to anyone who works in the Dallas area and presently has 48,000 names in its data base.

When the program was started, information booths were established in major office buildings to provide application forms, and the department has since hired an advertising agency to design a continuing promotional campaign.

If the goal of the program – to reduce the rate of passengers per car from the present five people in every four cars to six passengers in every four cars – is accomplished, 20,000 pounds less of pollution per day would be emitted and 40,000 gallons of gasoline would not be consumed, Haynes said.

The Connecticut Department of Motor Vehicles is taking another approach to soliciting car-pool participants. In October, it began sending car-pooling application forms to all motorists when they renewed their registrations.

As the program progresses, motorists wishing to participate will be sent printout lists of other participants in their area. New applicants will be added and persons who have formed car pools will be deleted from updated lists.

After six months of operation, Denver officials estimated some 80% of those who have inquired about a smaller scale program there have actually begun car pooling.

The Colorado Air Pollution Control Commission requires all employers of 50 or more people to offer a carpool locater service to employees, according to David Pampu, assistant director of the Denver Regional Council of Governments. Participation is strictly voluntary, he noted.

More than 15,000 Denver residents used the service in the first six months of operation.

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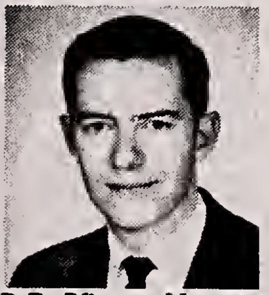

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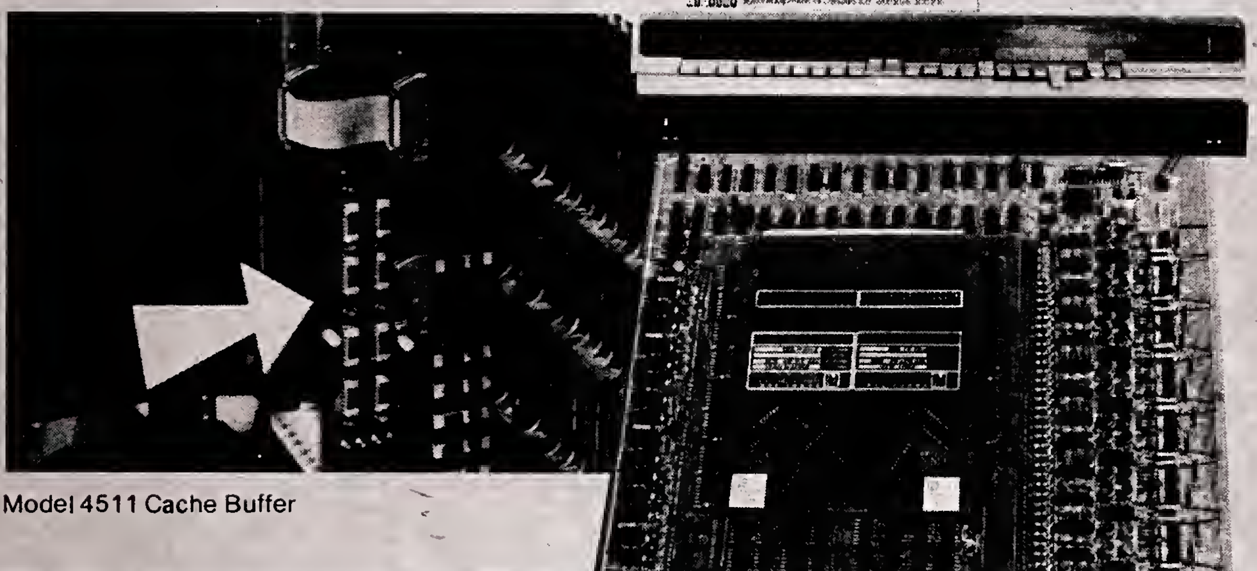

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Editorial

One Step Forward

U.S. Attorney General Edward H. Levi should be congratulated for shelving the Federal Bureau of Investigation's (FBI) plan for a computerized message-switching system for criminal history information [CW, Nov. 19].

Clearly, his action must have come up against a great deal of internal pressure from the bureau to establish such a system, since the FBI is not known to be shy about pushing requests that would expand its bailiwick in the criminal justice field.

However, the move does not go far enough.

Criminal history information is still the responsibility of the FBI, even though it will not be allowed to set up a special network for the interchange of such information.

This should not be so.

Criminal history information is extremely sensitive, since it includes information on all arrests, even if they did not result in convictions or even trials. The FBI's internal procedures are not strong enough to ensure that the records are updated to include information on the disposition of the case.

Centralizing this information, which may be inaccurate or misleading, is not necessary for any law enforcement purpose, since many people whose names would be in the file never have been found guilty of anything.

Clearly, this information differs drastically from the other types of information found in the bureau's National Crime Information Center (NCIC).

Most of that information concerns wanted persons, stolen cars, guns or securities. It is information that is needed immediately by policemen in the field and is about people or things sought by police agencies.

The criminal history information stands out like a sore thumb among these other files.

It is not about people who are currently sought in connection with a crime, but rather about people who have been arrested — whether rightly or wrongly — sometime in the past. People, often who were just in the wrong place at the wrong time.

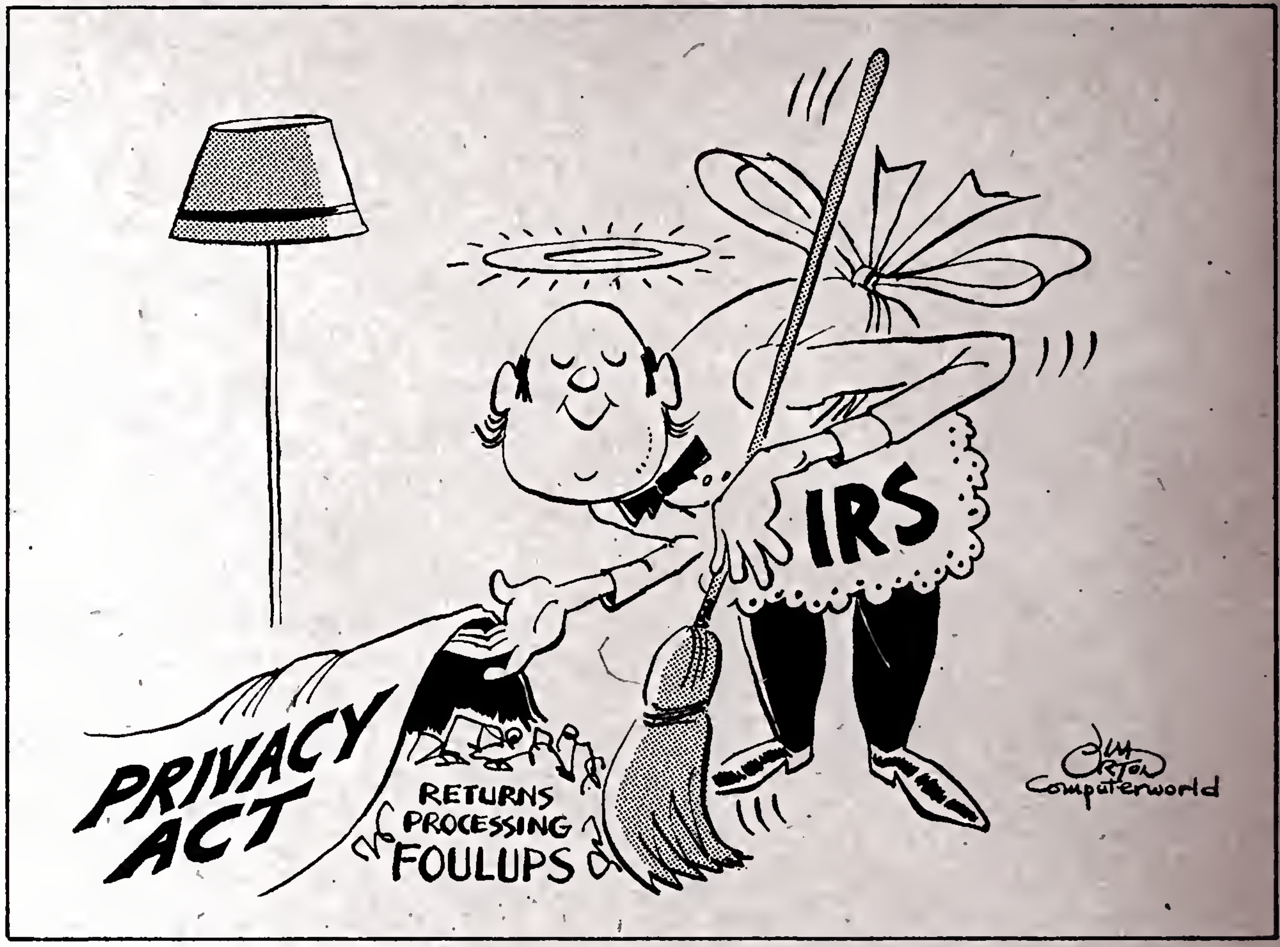
Under our system, a person is innocent until proven guilty in a court of law. By maintaining criminal records on anyone ever arrested — whether found guilty or not — this concept is in danger. A person is branded by an arrest record, whether or not he is guilty.

So Levi should take the next step and ban the collection and centralization of this type of information at all levels.

Records on persons arrested, but either found innocent or released without a trial, should be destroyed. They serve no legitimate purpose and undermine our concept of guilt and innocence.

If Levi is not willing to go this far, as he should, then he should remove the responsibility for keeping the records from police agencies such as the FBI and place that responsibility with a more neutral agency such as the court system or a body especially created for the purpose.

The responsibility for these records should be removed immediately from the FBI, pending a final resolution of the issues they raise.



Letters to the Editor

Other Possibilities Exist For Monitoring Government

I was fascinated by the article on congressional use of data processing in the Nov. 12 issue, especially where *Computerworld* told of plans to tie into the Executive Branch checkwriting computer so Congress would always know where the taxpayers' money was going.

I am surprised no one mentioned an even more desirable computer possibility. If Congress were to tie in the vote-tallying computer with the budget computer, it could program it so that, whenever a vote was cast for an expenditure of funds without an accompanying revenue bill, the voter would get a NO-OP.

Walter E. Wallis

Menlo Park, Calif.

Non-Bell DAAs Won't Be Free

In a Nov. 5 editorial, *Computerworld* stated that the California Public Utilities Commission is allowing non-Bell modem manufacturers to build Data Access Arrangements (DAA) into their systems and sell the complete package to the user.

The upshot of this feature is that the user will no longer incur the additional expense of the DAA.

However, will this in fact be true? The utilities company argument against this action is that the equipment will have to be certified by some independent group, and this certification will not come free.

The cost of the certification will in turn be passed on to the customer and, as a result, will eliminate the advantage of doing away with the Bell DAA, according to the utilities company spokesman.

I think readers would be interested in California's experience in this respect.

B.L. Pittman

Denton, Texas

DP Could Help Sort Mail

Regarding the article on the post office [CW, Nov. 5], it is extremely curious that the U.S. Postal Service, which has been described as the largest DP organization in the world, appears to preoccupy itself with "blue-sky" computer projects.

The so-called Kokomo plan for automated carrier route assignment appears to be a prime example of this.

The obvious area where the post office could reap the greatest benefits in computer technology is in the actual sorting of the mail. This occupies 20% to 25% of the average mail carrier's time and is obviously a much larger percent of the average mail clerk's time.

Yet, even in this area, the "blue-sky" approach of print-font reading of Zip Codes has been taken. I understand from what I've read that only modest success has evolved from this several-year project.

As a person who has been involved in the dull, tedious activity of sorting mail by hand both as a U.S. postal clerk and carrier and as a person who now enjoys the satisfying work of computer programming and systems analysis, I continue to be disturbed.

If a stamp or envelop were designed to accept mark sensing, letters could be sorted by relatively simple machines utilizing mark-sense technology (a technology that has been around for decades).

An expansion of the Zip Code to nine or 10 digits could allow for the automatic sorting of mail to the individual.

Howard Glastetter

Olympia, Wash.

Industry Has Responsibility

Laurance F. Wygant's response [CW, Nov. 5] to my letter [CW, Oct. 8] indicated a need for clarification of some issues.

Originally, I questioned the humaneness of a *Computerworld* article that expressed a sense of meritorious achievement because computer-generated statistics were useful in the support of pro-abortion legislation at Barbados.

Such statistics represented probable trends, not certainties. Was the data provided to prompt hope or despair? What kind of hope is it that is aroused which results in legislation that supports human death of the most defenseless of humanity, the unborn infant?

Does not the computer industry have a burden of responsibility regarding the use of its productivity?

David A. Fuller

Renton, Wash.

Seminar Response Overwhelming

I would like to express my thanks to *Computerworld* for publishing my article "Seminar Can End Structured Programming Confusion" [CW, May 28].

Reader response has been overwhelming and came as a pleasant surprise.

To date, there have been over 800 requests from U.S. companies, over 60 from Canada and an equal number from overseas. I would like to thank all those who responded to the article.

Gopal K. Kapur

Danville, Calif.

(Other letters on Page 10)

Computerworld welcomes comments from its readers. Preference will be given to letters of 150 words or less. *Computerworld* reserves the right to edit letters for purposes of clarity and brevity. Letters should be addressed to: Editor, Computerworld, 797 Washington St., Newton, Mass. 02160.

Documentation Must Reflect Viewpoints of All Users

By Joseph T. Rigo
Special to Computerworld

It has become fashionable to talk about looking at a computer system from the users' point of view.

The catch, for members of a developlent project team, is that there is no single user viewpoint. The data-entry staff has one set of needs. People who use the output reports have another. And the West Coast salesman has a third.

Their different requirements must be reflected in the project's documentation: Three points in the development life cycle are particularly critical.

First is during the system study when analysts and users are investigating the current system, if there is one.

Second is in the preparation of requirements and functional specifications for the new system.

Third is in designing user manuals and other reference materials for the operational system.

It is not enough to cover all topics somewhere in the mass of paper. The material must be presented in ways that are meaningful to those who review and approve drafts.

This is not accomplished by dropping a massive report on a manager's desk and asking for sign-off in 10 days.

Poor user documentation has identifiable symptoms, just like bad programming. Often, however, project teams are not alert to these symptoms. They blame their troubles on public relations or personality differences.

Calmness a Bad Sign

One odd but real symptom of bad documentation is that user supervisors remain calm during the system study. This means the project team is simply collecting data for programming specs.

Reader Commentary

Analysts are not digging into the user's work flow and reporting information to give supervisors a fresh outside view of their daily operations.

When the study team is doing a thorough job, supervisors are horrified to find out what has been going on. The problems may not be enormous, but the supervisors make immediate changes to correct them. While they are at it, the supervisors throw in some other ideas they have been meaning to implement for years.

These actions help the users smooth out current operational bumps while the new system is in development.

There are other, more conventional symptoms of bad documentation:

- Objectives change daily. Users' true requirements get twisted to fit the capabilities of a favored software package.
- Users do not participate actively, and they stall on key decisions. Yet they sign every approval form put in front of them.
- Despite frequent meetings, it is not until system test that key user staff members raise objectives to the system design that cannot be overlooked.
- Parallel test lasts forever.

There is a different set of symptoms after the end of the project. Most commonly, the users simply ignore whatever documentation was provided.

There are other indications of poor work.

- The users "lose" parts of their system. They keep asking for modifications to implement features they already have.
- Clerks cross out totals in their computer-generated reports. They consult notes scrawled on the backs of envelopes and write in new totals. They know there are errors in the master file. The system includes a program to adjust errors, but the users are afraid to run it.
- If you are a software vendor, you modified your user manual to give your customers exactly what they asked for. They still don't like it.

The fastest and easiest way to make some improvement is to organize reports, specifications and manuals according to users' staff jobs. For example, consider an application involving the following activities:

- A customer inquires by mail about a product.
- The inquiry is referred to the salesman who is responsible for the customer's region or industry.
- The salesman contacts the customer and reports the results back to the home office.
- The sales manager periodically reviews a record of recent inquiries and the results of sales calls.

The company develops a computer system that is involved in each of these steps. The project team supplies a user manual.

Chapter 1 contains layout forms for all files, records and input cards.

Chapter 2 contains a printer spacing chart and a sample copy for every report, form or letter produced by the system.

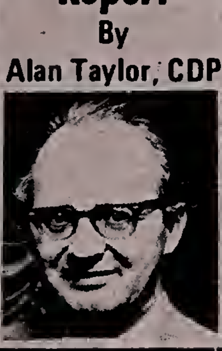
Other chapters list error messages and contain instructions for filling out the form to get on-request jobs run. Inevitably, there is a system flowchart somewhere in the manual. It is beautifully drawn and professionally accurate, but it doesn't mean much to the West Coast salesman.

(Continued on Page 10)

RPG Forges Ahead of Cobol With Five-Part System

The latest development on the commercial computer front came from Data General Corp., where Bob Nichols and Steve Schliemer have replaced the standard single-program language compiler concept with a five-program "package," including a compiler, two source-language and two object-time quality controllers, all bound up into a language system.

The Taylor Report
By
Alan Taylor, CDP



In doing this, they have left the other major commercial language, Cobol, far behind.

The new system, called the Eclipse RPG-II language system, is already operational in the field. It provides a user with standardized aids to accuracy and productivity during program running and during all the development and modification phases that precede actual operations.

This can prevent users from having to use potentially important and sensitive running in order to test an application or a change – a practice which has little to recommend it, but is used far too often by our profession.

Instead, simulated running and inspected object-program analyses can precede any use of the program and permit a greatly improved acceptance-test facility to be insisted upon by users.

Naturally, such developments do mean professional programmers have to take on the responsibility of being able to use the tools provided and so upgrades their profession.

Hopefully, most programmers will welcome such upgrading of the service they can give to their employers and clients, and we won't be plagued with more of the "assembly-superiority" arguments that held back Cobol for so long.

Programmer Productivity

The precompiler or editor's major function is to increase the RPG programmers' productivity. It approaches the task in the standard way of providing syntactic line-by-line analysis of the source code in a multiterminal interactive manner, thus keeping the machine cost down. New specifications can be added, old ones changed, numbering can be recalculated, etc. – all of which helps both early programmer productivity and program modifications. And, of course, its use cuts down on the number of compilations needed before a clean object program is created.

The post-compiler, or program analyzer, is the most ambitious part of the language system. This produces an as-easily readable program as any Cobol system. For instance, file handling is described file by file, interpreting the meaning of the various specification entries so that one doesn't have to be an expert RPG programmer to notice errors in handling the files or the computations.

Beyond the interpretation of the coded RPG input, the analyzer documents the results of having various indicators on in separate paragraph-like blocks. Each block gives details of where the indicators are turned on and all the various results that ensue.

This prevents modification of one part of a program from introducing errors into another part of a program.

The final part of the postcompiler is the production of printer-type output showing the format, the picture and name of the various fields and the relationships between alternative or superimposed formats. The user, then, can expect the correction at the postcompiler stage of many program errors which otherwise would not be found until testing or production had started.

Once the object program has been tested for errors that are simply program errors, the problem of testing the program arises. Too often this is left out of the process, and the user is left doing the tests with live data. The Data General-run simulator (called RPG debugger), provides a test-bed for the program testing which allows the introduction of specific data, setting of breakpoints, modification of indicators, etc. under programmer control from an interactive terminal. It provides, as well, an entry into the dumping procedures which the run simulator shares with the actual production-run facilities under this system.

System Part	Programmer Use	System Action	User Results
Precompiler	Writes raw source code or uses earlier code from library.	Checks raw source for errors and gives aid in modifications.	Increases programmer productivity. Reduces wasted compilations.
Postcompiler	Checks output interpretations of logic, formats of reports, etc.	Interprets and documents the object program in source-code terms and outputs.	Provides documentation without programmer effort. Provides easy-to-understand highlighting of programming errors before any testing needed.
Run Simulator	Originates testing plan for either general or special cases and carries it out.	Operates with real or forced data, with snapshots, etc. in source language.	Permits (but does not require) testing to be handled and documented before a program is accepted for live-data testing. Provides an immediate and standard way of treating a production program problem area with little delay.
Run Controller	Sets automatic abort procedures or provides for operator actions in operating instructions.	Activates cross-referencing between source-language program and machine code and provides understandable output to RPG programmer.	Provides standard documentation of abort-causing processing with chance of increased quicker error discovery and run-correction.

The four parts of the new Data General RPG language system which complement the compiler itself are described above in capsule form, together with the advantages a user can expect from the use of such language systems, as opposed to simple compilers. It should be noted that the run simulator can be used after as well as before the run controller.

Production-Running Check Points

The final stage of program use is, naturally, the production run. Even here, however, there is always the chance of something going wrong, either in a totally unexpected way or else in some way in which the programmer would want to halt further processing until some action outside the program running could take place.

Data General provides for these program needs with a run controller. This allows manual or preprogrammed calling in of a formatted dump which includes details from the source program (table names, etc.) to assist in understanding what was going on when the mishap occurred.

Internal variables, such as the last table entry that was looked up for all the tables, and details of actual formats used, such as packed decimal, etc. are included.

In addition, the manual provides cookbook-type instructions for the use of a formatted dump.

So, there it is. The language system consists of a compiler, a precompiler to look after source-code problems and a postcompiler to document in an understandable fashion the object code produced. A run simulator for whatever test procedures the ingenuity of the programmer or the demands of his user require and finally a run controller to force necessary aborts to bring with them already-translated and processed information in terms of the source program, not just in terms of what is contained in various forms of memory.

It's a real advance toward the day when high-quality programming is expected to provide freedom from surprises and user controls over his active programs as well as over his programs in development.

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Letters to the Editor

CW Coverage Spotty On 'Number Crunchers'

I look to *Computerworld* for a nontechnical overview of the entire field of computing.

What areas CW does cover, it covers well.

However, the coverage is often very spotty, and I object to this. I know there is only so much that can be covered each issue, but there are those of us who are interested in areas of computing including, but extending beyond IBM computers, IBM software, business data processing and related material.

CW does tend to forget there are people out there who use Control Data Corp. "number crunchers" and use them for other than business DP applications.

The reporting on the Amdahl extension of IBM-type equipment and the desire to hear of the CDC-type extensions Seymore Cray and Cray Research, Inc. have produced in the Cray-1 Computer served as the catalyst for this letter.

Rayner K. Rosich
Arvada, Colo.

Free Spirit Speaks

Even though Jerrold Asher's visions of the "professional image" [CW, Nov. 12] will likely become reality some day, not everyone shares his particular dreams for the future.

Asher claimed "programmers seek respect on the one hand while condoning freedom of spirit on the other. The two don't mix." This depends on the type of respect sought.

If one wants the "respect" of people whose already confused thoughts can be completely snowed by a clever program of public relations, then Asher is right.

Programmers can emulate doctors and lawyers, whose professionalism is the apparent target, by wearing lab coats or similar vestments (perhaps with a red stenciled "P" on the front?) and burying "every major or minor proceeding in pounds of documentation . . . written in obscure terms only they can interpret."

What value respect has under such circumstances is not made clear.

However, if one would rather have the respect of people who understand and rationally appreciate one's abilities and performance and be judged solely on the basis of one's work, then freedom of spirit and professionalism are not incompatible, but are absolutely necessary for each other.

The economic issues brought up in the article were also disastrous. Asher drooled over the guild structure of the legal and medical businesses as a model for DP.

But holding the public hostage by a scheme of price-fixing, eventually to be supported by coercive governmental measures, as it has been in those other industries, does not seem to be a wise way to get public respect.

Perhaps some people yearn to be overpriced maharajas of data processing. I do not.

It is sad that computer programming cannot be spared the trappings of the professional mystique. Before freedom is sold out to such dubious "professionalism," however, it should be known that, among us unprofessional programmers, the "mysterious alchemy" which awed Asher so much is known in our free-spirited language as "bullshit." Anyone who desires to build professional respect on such a shifting foundation deserves whatever he gets.

Glenn E. Sieferman
Chicago, Ill.

Check Digits Unneeded

My only possible reaction to Alan Taylor's rather heated discussions recently over check digits is "yawn." My firm unfortunately is too small to need a sophisticated predata entry technique like check digits.

We are not fortunate enough to have all of the preprocessing requirements of key punching, edit runs, batch updates and all of the things that keep big busy companies running their computers 24 hours a day.

Our Singer System Ten (which ranks somewhere about 3 inches off the ground on the totem pole of system hardware/software sophistication) somehow manages to do direct access into master files by use of a CRT display terminal – the CRT readout tells us whether the account that was entered is valid or erroneous, and we somehow manage to keep seven application systems on-line at all times.

It also does direct file updates (with numerous controls built in) and we have never done an edit run. We don't have a computer card or a tape diskette on our premises.

Ah, if we could only have a larger machine for more sophistication.

Perhaps Taylor will someday realize things like check digits belong in the history books of data entry techniques.

Maybe one day large-scale computer data entry systems will progress to the point where thousands of on-line minis are today.

Edwin Levy
Philadelphia, Pa.

Out in Left Field

Kenneth L. Morris [CW, Oct. 15], Roger Poole [Nov. 12] and all other Cobol programmers who must debug Abend dumps at the core level will be pleased to know that a book which directly addresses this topic will be available shortly.

This coming April, John Wiley & Sons will publish my book, entitled *Abend Debugging for Cobol Programmers*.

The book provides integrated methodologies which assist the OS/Cobol user who must debug dumps at the machine level.

B.H. Boar
New York, N.Y.

Help on the Way

The recent Taylor Reports on check digits were way out in left field.

Check digits are appropriate for numeric identification codes, but the vast amount of computer input isn't or can't even be batch-totaled for validation.

And surely common batch-total techniques can't compare with the error-catching ability of clever check-digit schemes.

I wish Alan Taylor and *Computerworld* readers would think more about the broad category of data validation than just check-digits.

Peter Rennick
New York, N.Y.

Documentation Must Consider Users

(Continued from Page 9)

The simplest improvement is to take the same material and sort it on a different column. For example, create a separate chapter (or document) for the person who will record the initial customer inquiry.

This chapter contains the card format for making the entry, information about how to get the customer inquiry program run and a sample copy of the report that the clerk will get in response. The chapter includes an additional page or two about what to do with copies of the report and who to call in case of trouble.

Similarly, subsequent chapters contain the material that is relevant to each of the other three activities. The flow chart gets sent to the systems maintenance staff where it can best be appreciated.

This approach to organizing and presenting information should be followed from the very start of the project. Each user finds it easier to review drafts and suggest changes if he is not swamped with data about someone else's job.

Rigo is a documentation consultant based in New York City.

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Mark IV Speeds New Systems

Gentle Approach Lets Users Keep Old Input, Output

By Don Leavitt
Of the CW Staff

ST. PAUL, Minn. – The end user of a company's DP capabilities – the supposed beneficiary of the systems – often becomes utterly frustrated with the demands and time delays that seem to be inherent in a Cobol-based development operation.

The situation gets so bad "in many cases [the user] doesn't even articulate his full needs anymore" because of the frustrations he experienced in the past, according to Douglas Smith, director of materials, management systems and planning at Buckbee-Mears Co.

Smith said his company overcame many of the users' frustrations by acquiring a package which provided an orderly structure for the development process. "About two years ago we purchased Mark IV [from Informatics] as a procedural language, a file management system and a report generator," the manager explained.

The conglomerate took a gutsy approach. The software "was not purchased as a secondary language, but as a total replacement for Cobol. Since that time, all new systems and virtually all reports have been coded in Mark IV," Smith added.

New Development Approach

Along with its new support package, Buckbee-Mears put together a new approach to developing systems. In outline form, it calls for the DP staff to:

- Review the current (or proposed) system and identify the types of reports and inputs desired by users.
- Define the data fields and file structures needed to support the users' desires.
- Implement new file structures with current input and output reports.
- Develop and implement new reports and system extensions incrementally.

The initial review "differs . . . in depth and in detail" from what Smith did in the past. "We do not detail report formats, input documents or program decisions," he said. "We develop a broad concept of the types of reports and capabilities the user expects of the system."

Next Buckbee-Mears "defines the data fields that will be necessary to provide the types of reports desired.

"It has been our experience that these can be defined without having to specify report formats. In fact, we find it easier to develop information requirements with a user," Smith noted, "if he does not have to identify a specific report where [the information] will appear."

File structures are then designed to provide maximum flexibility for updating and outputting the data. The DP staff attempts to arrange the fields in the logical way without regard to complexity of hierarchical structure or record size and to minimize the number of files, Smith explained.

Concern for Users

Concern for the user shows up clearly in the next step. The DP staff writes programs to update the newly defined file structures from current inputs. Output reports are written from the new file structures with minimal changes.

"This approach allows us to check out the system," Smith said, "without reducing the confusion which accompanies most large conversions when users are given new inputs and outputs."

Once the base system is judged to be fully operational by both the DP staff and the users, extensions are considered. In any project, he noted, there are a number of report requests or other changes built up during the implementation phase.

In conventional Cobol-based operations, such enhancements may have programming time and cost considerations equal to those of the base project itself, but they "can be quickly coded in Mark IV with the new file structures," Smith asserted.

Coding ease has been matched by other efficiencies, according to Smith's estimates. The pilot system was a materials inventory operation servicing purchasing, material stores, accounting and production functions. Though complex, it required only eight man-months to develop and execution time was reduced 50% compared with the earlier Cobol implementation.

The job order system – "very complex" – provides 22 reports to three divisions on job status and job costs and edits and balances attendance and job hours. Execution time is the same as the old system, Smith admitted, but disk space has been reduced 90% and the information is "immeasurably better due to more comprehensive and selective reports."

Training takes up "probably a quarter of the time" needed for training in Cobol. There is less risk involved in assigning trainees to major systems in Mark IV since there are fewer options available to them and it is much easier to clean up poor program design, Smith concluded.

Univac 9000, Series 70 Sites Promised Help Moving to VS/9

BLUE BELL, Pa. – Users of Univac 9000 series, Series 70 and Series 90 CPUs have been promised a set of routines to ease conversion to machines running under Virtual Memory Operating System (VS/9). The support will be ready the third quarter of next year, Univac said.

The routines include source language translators for Cobol and Assembler, an RPG-II compiler for the VS/9 environment and features added to the operating system itself "to make it more compatible with OS/4."

Announced in January coincidental with the "death" of OS/7 [CW, Jan. 29], VS/9 is the control software provided by Univac for models 60 and 70 of the Series 90 equipped with a dynamic address translation (DAT) box. The operating system and the DAT box were first delivered about a month later.

OS/4 is the operating system originally offered with the earlier nonvirtual models of the Series 90 line and with newer models of the 9000 series. Originally developed by RCA, TDOS and DOS have been regularly enhanced by Univac since it took over the RCA user base as its Series 70.

The source language translators accept Cobol and Assembler programs, including user-written macros, developed under OS/4, TDOS or DOS. From these, they generate equivalent program acceptable to the VS/9 language processors, Univac explained.

Transcriber Routines

Library transcriber routines transfer source, macro and Cobol Copy libraries to VS/9 files, and other routines allow disk files now under the older operating systems to be dumped and reloaded in formats acceptable to VS/9 operations.

The VS/9 RPG-II compiler is described as "highly compatible" with the OS/4 compiler. Among the special features added to VS/9 itself to aid conversions is a procedure capability for the VS/9 assembler, Univac said.

Existing facilities in VS/9 also support moves to the system, a spokesman noted, pointing to a virtual memory editor for applying source changes to programs and an interactive debugging aid.

All of the newly announced conversion aids will be distributed free.

Hierarchy Diagrams, Lists Called Control Keys

By George Waybright
Special to Computerworld

Concepts and Techniques

In developing systems, much more importance should be attached to the active use of the program hierarchy. Although the concept of the hierarchy appears in most discussions of structured programming, references are usually no more than mentions of its existence.

In fact, the hierarchy should serve as the central theme throughout program design, implementation and maintenance, providing the basis for continuity throughout the system's life cycle. It exists in any program where the three structure rules (Sequence; IF . . . THEN . . . ELSE; and DO . . . WHILE) are strictly employed and is actually forced into the program as a result of using those rules.

Herein lies one of the problems of current thinking. Usually the programmer is given the rules and told to develop his program with them. When the emphasis is shifted to the hierarchy, the program is designed as a result of functional analysis and then implemented using structured rules!

But this requires techniques to aid the programming team in focusing on the hierarchy from early design through implementation and maintenance.

Documentation Tools

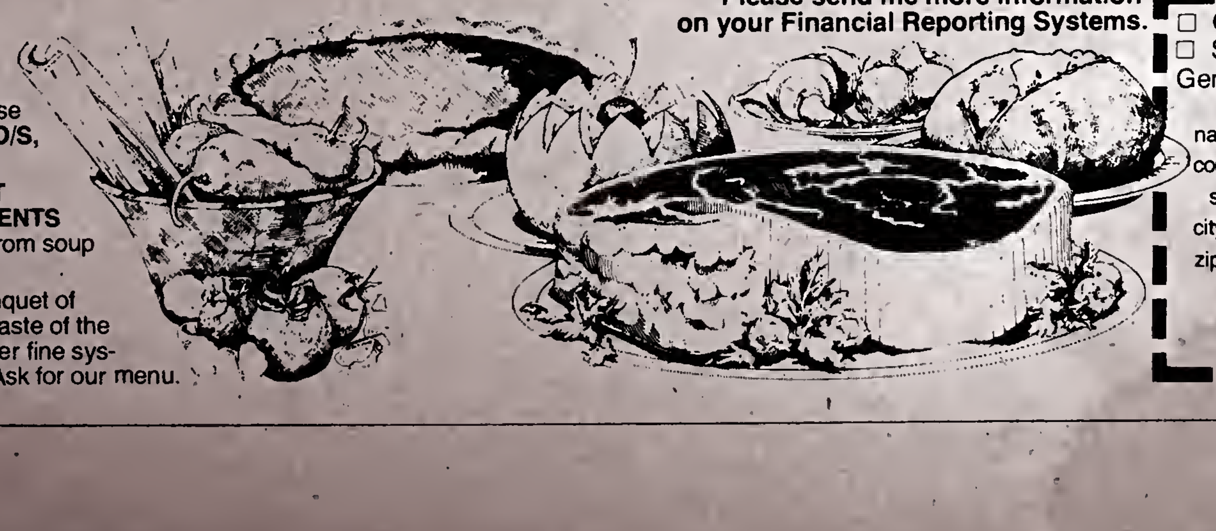
For our own work, we developed two tools which document the hierarchy and make it more visible to the programming team: a functional diagram and a paragraph structure report.

The first is a simple design document, prepared manually by the programmer, as shown in Figure 1. If the programming team has done a detailed functional analysis of the information system to be replaced, this becomes an extension of that analysis. The design is a restructuring of existing and new functions to be implemented as a programmed system.

We follow several rules to ensure continuity and completeness in preparing the functional diagram. A naming guideline states each function name in the diagram is to be shown exactly as it is to appear in the program.

In using the Hierarchical Input Process Output (Hipo) method of documentation

(Continued on Page 13)



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Regional CMGs Set Meetings

Regional user groups affiliated with the Computer Measurement Group (CMG) [CW, Oct. 22] have scheduled meetings in December.

Northeast CMG, New York City, Dec. 8; meeting will plan the program and direction of this regional group for 1976; contact Barry Stevens at Peat, Marwick Mitchell & Co., 345 Park Ave., New York 10022.

Southern CMG, Nashville, Tenn., Dec. 8-9; presentations on networks, mass storage systems, direct access subsystems and the Amdahl 470; contact Larry Barnes, Room 203, Andrew Jackson State Office Building, Nashville 37219.

West Coast Measurement and Evaluation Group, San Francisco area, Dec. 10; presentations of computer performance evaluation products by vendors, election of local officers; contact Bruce Grant at Stauffer Chemical Co., MID Technical Services, P.O. Box 3050, San Francsico 94111.

Texas, Oklahoma and Kansas, Tulsa, Okla., Dec. 16; initial meeting at which Phil Kiviat, technical director of Fedsim, will speak; contact Bill Miller at American Airlines DP&CS, 3800 N. Mingo Road, Tulsa, 74151.

Package Aids Datasystem Users

TAMPA, Fla. – Support for easier data entry, updating, inquiry and report generation on Digital Equipment Corp. Datasystem 310s and 350s was the compound design goal of the Data Entry/Forms Generator package now available from Business Information Systems, Inc. (Bisi).

Comparing the capabilities of its package to those provided by DEC with the Datasystem 340, Bisi said it allows users to start building and working with data files "immediately," even before they become proficient in programming.

The format descriptor portion of the package enables the user to get up CRT screen displays designed to coach clerical personnel through the data entry operations of individual applications. A cursor leads the clerk to the next blank to be filled in and the display text shows what information is needed.

Internally, input is edited for valid field length, type of data (alpha, numeric or mixed), range of values and check-digit verification. Errors cause an audio signal and an error message, Bisi said.

Hash totals can be accumulated on as many as 10 fields for audit purposes. Meanwhile, automatic duplication reduces repetitive keying and the system allows initial values to be set so each processing run starts correctly.

Updating operations include retrieving, displaying, modifying any existing field and writing the record back to its original position. Both direct access of sorted files and sequential access for unsorted files are supported, the vendor said.

Under control of the installation management, display and updating capabilities may be open to all personnel with access to the system keyboard or limited to specific, presumably nonsensitive fields.

The Data Entry/Forms Generator is available under license for $1,000 for the first system and $500 for additional licenses from Bisi at 303D Whitehall Court, 33604.

Compact Conferences To Consider Concepts

NEW YORK – A series of one-day "state of the art" conferences in January will touch on many aspects of structured programming and open a dialog between participants and "five of the finest minds in the computer industry today;" according to Yourdon, Inc., which is sponsoring the meeting.

Planned for presentation in three cities – New York, Boston and Chicago – on consecutive days in mid-January, the conference will include presentations by Gerald Weinberg, Larry Constantine, William Plauger, Tom Plum and Ed Yourdon.

Author of *The Psychology of Computer Programming*, Weinberg will talk about programming teams and structured walkthroughs. Constantine is expected to touch on structured design and its impact on structured programming.

Plauger, coauthor with Brian Kernighan of *The Elements of Programming Style*, will focus on style and discuss, among other things, why eliminating GOTO statements does not ensure a readable program.

Serving primarily as moderator will be Plum, an author of various articles, including one on "remedial programming," and an associate of Weinberg's at Ethnotech, Inc. in Lincoln, Neb.

For his part, Yourdon will discuss the practical problems of implementing structured programming and the associated "programmer productivity" techniques in a typical DP installation.

Following each speaker there will be plenty of time for a question-and-answer period, the sponsor said, noting "after all, the subject of structured programming is not without controversy."

Attendance at any one of the three presentations of the conference, scheduled in New York on Jan. 19, Boston on Jan. 20 and Chicago on Jan. 21, costs $95.

Registration and inquiries are being handled by Yourdon, Inc., 1133 Ave. of the Americas, here in New York, 10036.

Clarification

The special issue of *Computing Surveys* cited by Daniel Couger in "Structured Program Guidelines Found in ACM Effort" [CW, Nov. 5] was dated December 1974. It is still available for $8 per copy from the Association for Computing Machinery, 1133 Ave. of the Americas, New York, N.Y. 10036.

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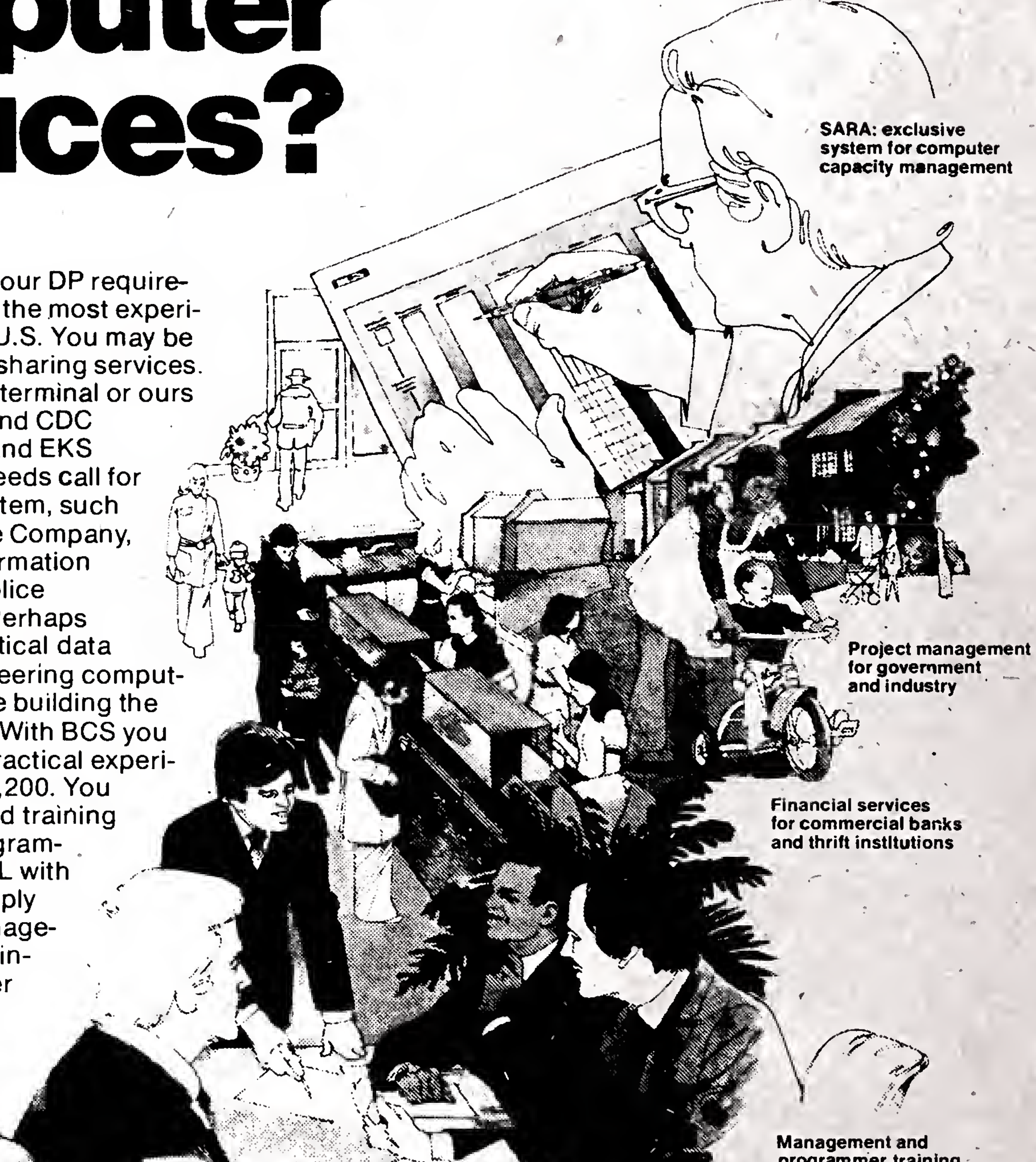
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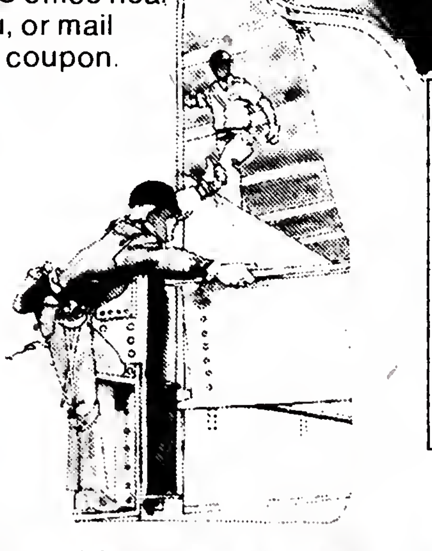
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Manual Diagram, Generated List Of Paragraphs Seen Control Key

(Continued from Page 11)

developed by IBM or a similar technique, the lowest level of documentation required would consist of generally describing the function of a given program paragraph, leaving the detail definition to be the statements which make up the program paragraph.

In preparing the diagram, the programmer consults with the team leader (lead programmer) and management to evaluate not only the program design, but also the meaning of significance of the paragraph names.

Further, there is an attempt to improve the meaning of the total hierarchy to better describe the processing of the program. The functional hierarchy becomes the table of contents for the program and should describe each function of the program and show how each is related to the total structure.

This process becomes very powerful when the programming team has produced the documentation of a detailed analysis and will design, implement and document the new system. Having consistent function names throughout the development process and embedded in the programming system greatly enhances the total system documentation.

Because of the logical properties of a structured program, the hierarchy is computable. Since each reference point (paragraph name in Cobol) of a program has associated with it a span of control and each has a dependency relationship, it is a simple matter to develop an algorithm which produces the program hierarchy.

We developed a postcompiler system which analyzes the structure of a given program and outputs a paragraph structure report showing each reference point and its relationship to the entire program.

This, in concept, is identical to the functional diagram, but becomes more important since it is produced from the developed program. The manually-prepared functional diagram, therefore, becomes a historical document, and future reference to it may be for evaluation purposes only.

The computer-generated report represents the actual program contents and is always a current statement of the program documentation. If program functions are added or deleted, it is a simple matter to identify and modify the manual documentation.

```
01 GENERAL-UPDATE-PROGRAM
  02 INITIALIZATION-ROUTINE
  02 UPDATE-PROCESS
     03 WRITE-MASTER
        04 STORE-TOTAL-ACCUMULATION
        04 SELECT-NEXT-LOW-MASTER
           05 COMBINE-DUPLICATE-MASTERS
              06 COMBINE-DUP-MAST-SUB
              06 COMBINE-DUP-MAST-SUB
              06 COMBINE-DUP-MAST-SUB
              06 COMBINE-DUP-MAST-SUB
           05 MASTER-IN-SEQUENCE-CHECK
        04 MASTER-OUT-SEQUENCE-CHECK
     03 PROCESS-TRANSACTION
        04 UPDATE-MASTER
           05 DUP-MASTER-CREATION-ERROR
           05 UPDATE-MASTER-WITH-TRAN
              06 CREDIT-UPDATE
              06 DEBIT-UPDATE
```

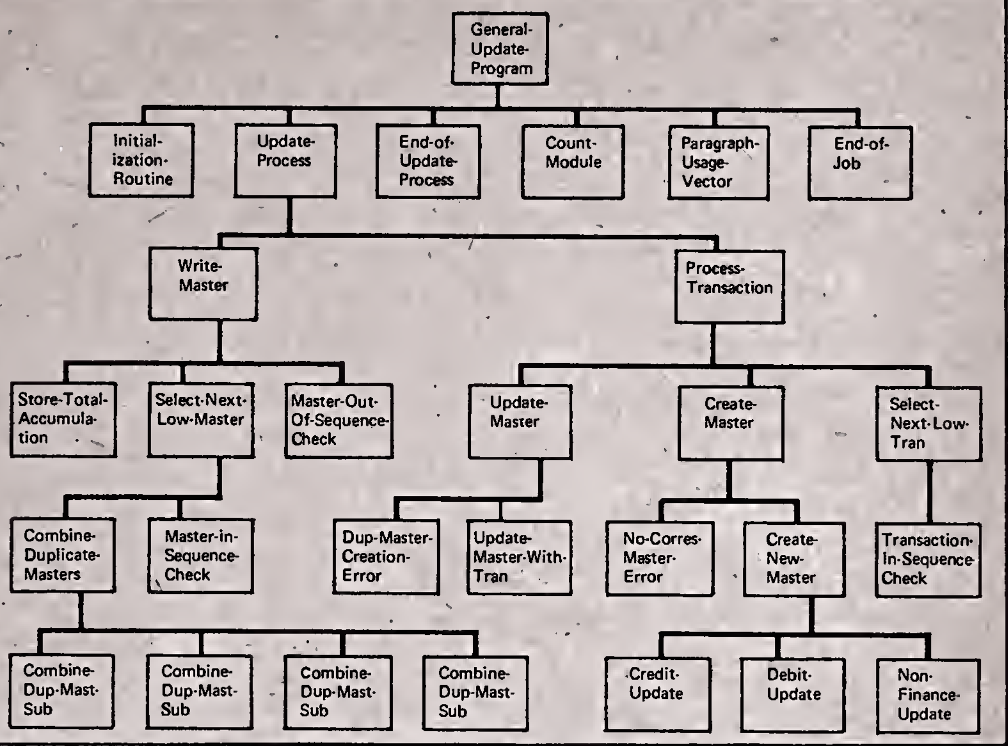
Partial output of postcompiler run shows dependency of paragraphs through indentations.

The majority of program maintenance requires modification of existing functions and adding or deleting entire functions without changing the basic design. The essence of the structured technique is that functions are logically related yet distinct entities.

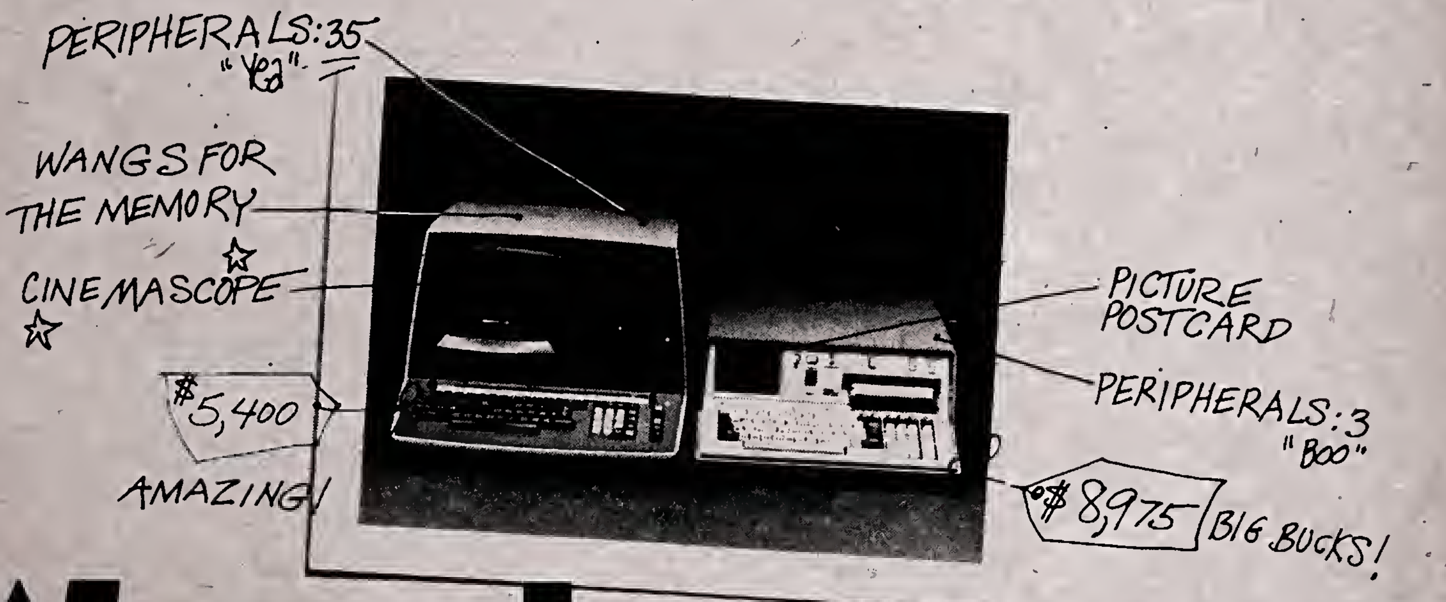
With the hierarchy showing these functions (named exactly as they were in the manual documentation) and how they are related, the maintenance programmer is assured much greater success.

There are several other logical extentions of the program hierarchy and function/data element relationships which would support more sophisticated systems development techniques; however, more work is required to understand them.

Waybright is manager of technical support, Management Information Systems Department, Belk Stores Services, Charlotte, N.C.



Waybright's manually prepared functional diagram (reset for clarity) looks like conventional organization chart.



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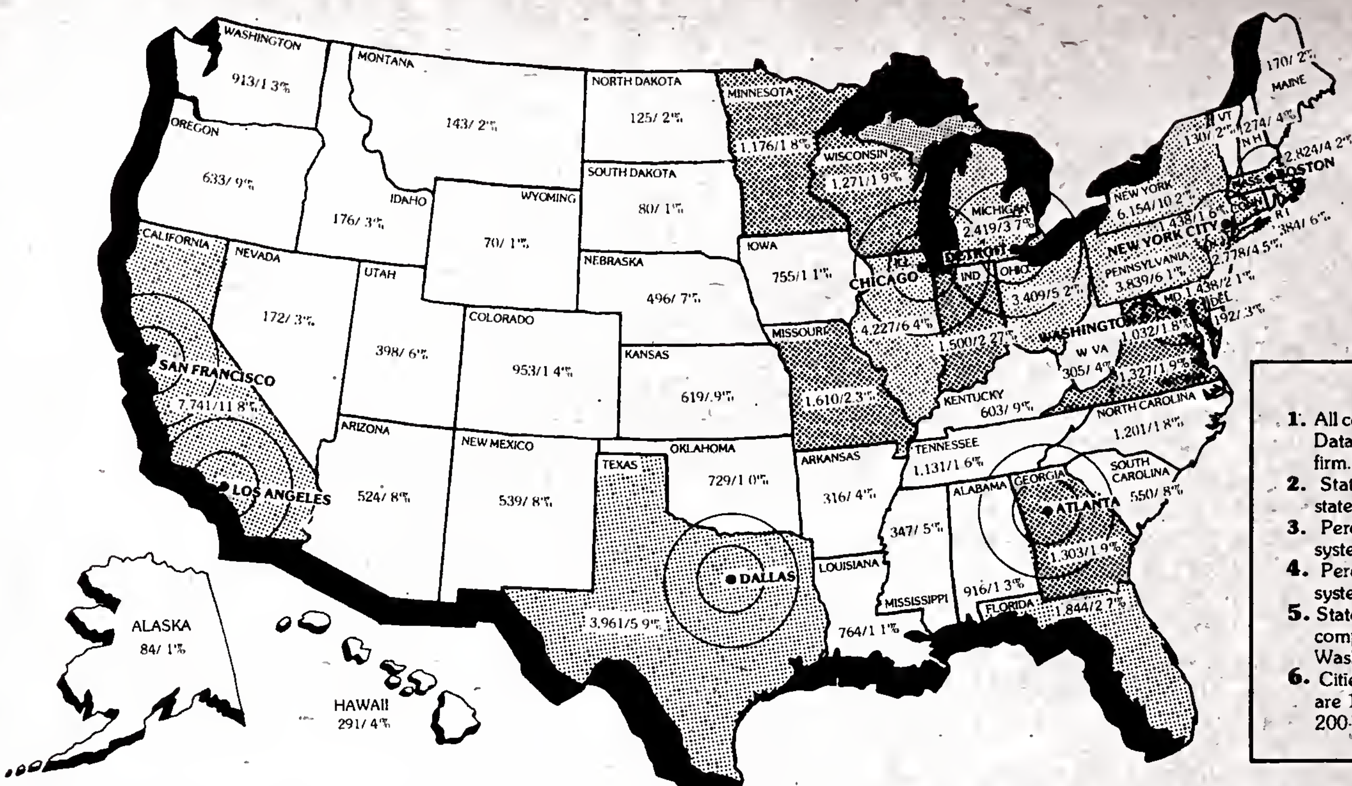

LEGEND

1. All computer figures are taken from projections of International Data Corporation, the world's largest EDP market research firm.
2. State-by-state numbers are number of *computer systems* in state.
3. Percentage figures represent percent of total U.S. computer systems installed in state, measured by value.
4. Percentage figures represent percent of total U.S. computer systems installed in state, measured by value.
5. States in lighter shading are ten largest measured by value of computer systems installed. States in darker shading and Washington, D.C. are next biggest.
6. Cities shown are 1976 Computer Caravan sites. Inner circles are 100-mile radius from city. Outer circles (where shown) are 200-mile radius from city.

Going your way is our way.

Computer Caravan/76 brings a national computer conference to key computer-using states across the country.

Measured by value of computer systms installed, the ten largest states in the U.S. (lighter shading on map) account for more than 60% of all computer systems in the United States. Adding the next biggest areas - 7 states and the District of Columbia (darker shading on map) - we get to more than 75% of all the U.S. Computer systems, measured by value. And it's these key states in the computer world which will be host to - or nearby - one or more of the nine cities in the Computer Caravan/76 - the travelling computer users' forum and exhibition sponsored by *Computerworld.*

To computer professionals, this means a unique opportunity to see a national computer show without leaving the office for a week and travelling across the country. It's a chance to keep up on the latest information in our user-to-user forums and on the latest products and services in our complete exhibition.

And thousands of computer professionals will take advantage of this opportunity as the Caravan moves across the country. The '76 Caravan can expect attendance of over 30,000 computer professionals, and unlike any other computer show, significant numbers of attendees will come from each of 15 states and the District of Columbia -- representing 65% of all U.S. computer systems installed. That's true national coverage.

As a marketer of computer products and services, the Computer Caravan offers you a unique opportunity to meet the professionals who run our country's computer installations in a one-to-one, business oriented atmosphere. Because there are 27 different show days, no one Caravan day is too crowded to give you the opportunity to present your products or services in detail -either on our exhibit floor, or in your own product seminar. And the 1976 Caravan offers several innovations which can make it more suitable to your individual marketing problems:

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AT&T Devices on Phone Net Must Be Certified: FCC

By Ronald A. Frank
Of the CW Staff

WASHINGTON, D.C. – AT&T equipment – as well as noncarrier equipment – must be certified and registered before it can be directly connected to the telephone network, the Federal Communications Commission (FCC) has decided.

That ruling was made in the commission's report and order issued recently to detail its decision allowing direct connection to the network [CW, Nov. 12].

AT&T is expected to object to this requirement, which marks the first time telephone company equipment will be required to undergo a validation process.

"We feel the FCC decision to extend the new registration requirements to equipment provided by the Bell System and other telephone companies is particularly ill-advised," an AT&T spokesman said.

"There is no logic whatsoever to the proposition that the regulated common carriers . . . should be arbitrarily required to submit their own equipment for government sanction," the spokesman added.

In its report and order detailing the events which contributed to the registration decision, the FCC said it had given the carriers ample opportunity to propose ways to "prevent harm without unduly restricting a customer's right to make reasonable use of the facilities and services furnished by the carrier. This the carriers have failed to do."

"The evidence before this commission amply demonstrates that many 'special' entities (e.g., gas, oil, electric and transportation companies, selected industrial firms, the Department of Defense, the National Aeronautics and Space Administration and customers in 'hazardous or inaccessible locations') have long been and continue to be allowed to connect their equipment and facilities directly to the telephone network by means less restrictive than carrier-provided connecting arrangements . . . apparently without causing harm to the network.

"We also note that there has been no demonstration of network harm resulting from the interconnected operation of some 1,600 independent local telephone companies and the Bell System . . . many of whom purchase and connect without benefit of carrier-supplied connecting arrangements the identical independently manufactured terminal equipment for which the individual user must lease carrier-supplied connecting arrangements," the FCC said.

The present AT&T tariffs requiring the use of Data Access Arrangements "impose an unnecessarily restrictive limitation on the customer . . . and constitute an unjust and unreasonable discrimination both among users and among suppliers of terminal equipment," the FCC said.

The certification/registration program scheduled to begin next April "will provide the necessary minimal protection against network harm which has been specified in various carrier operating procedures," according to the commission.

AT&T said the FCC's plan is "replete with technical and administrative shortcomings." As a result, AT&T has serious reservations about the ultimate impact of this decision on the quality and cost of telephone service, the spokesman said.

AT&T called the certification program "deficient in numerous aspects of network protection and the protection of customers and telephone company employees."

Asked whether AT&T would request reconsideration of the FCC decision, an AT&T spokesman said the commission's report was under study, but no decision on Bell's next step had been determined.

120,000 DAAs in Use

WASHINGTON, D.C. – After 72 months of interconnection, Bell System records provided to the Federal Communications Commission (FCC) at the end of 1974 showed about 80,000 Data Access Arrangements (DAA) had been installed.

This included about 22,000 manual (CDT) types and about 58,000 (CBS and CBT) types, an FCC spokesman said. Later cumulative totals were not available but, in the second quarter of 1975, Bell reported it had installed 6,062 CBTs, 4,349 CBSs and 1,398 CDTs.

Assuming these quarterly figures were typical for 1975, Bell probably installed another 40,000 DAAs of all types during the year. This means about 120,000 of the data couplers have been installed by the Bell System.

It is assumed Bell installed 90% of the total units in use with another 10% installed by the independent telephone companies, the FCC staff spokesman said.

An AT&T spokesman said the DAA totals had been furnished at the request of the FCC and the numbers could be provided only by a member of the commission. AT&T could not provide information on the amount of rental revenue that had been collected from the installation of DAAs, according to the spokesman.

NBS Aiming to Extend Government Networking

Special to Computerworld

WASHINGTON, D.C. – The National Bureau of Standards (NBS) Institute for Computer Sciences and Technology (ICST), under the direction of Dr. Ruth M. Davis, has been seeking to foster the wider use of networking in government to provide better services for citizens at lower cost.

"Our program is aimed at assisting agencies in selecting network services and using them effectively," she said.

Actually, the Federal government is already the nation's largest user of networking systems. Of the over 9,400 computer systems in use in government agencies, some 2,600 are already connected as a part of networks.

The fact that these 2,600 represent 60% of the dollar value of the federal computer inventory indicates that many of the networked systems are among the larger ones employed by federal agencies.

One of the recent NBS contributions in the networking area is the development of new measurement techniques for use in evaluating the service delivered by computer networks.

"By focusing on service delivered to the user, rather than on internal network performance, we can provide federal agencies with the information they need to procure the networking systems or services that best meet their individual needs," Dr. Marshall Abrams, an ICST engineer said. "Several agencies are planning to use our Network Measurement System during network system or service selection this year," he added.

Network standards and protocols are also an important part of the networking program, explained Ira Cotton, an NBS computer specialist. "Networking standards have been slow to develop in this country," he said.

"International groups are much further along in developing common ways of connecting users to networks and for interconnecting networks, even though much of the advanced networking technology was developed in this country." One of the problems is that communications engineers and computer specialists "don't speak the same language," he added.

"But I think we're getting over this problem, and we can expect to see some rapid progress."

Evaluating Solutions

NBS has also been active in proposing and evaluating solutions to problems that may impede effective network use, in areas such as network access and network security.

"Our network access project recognizes the problems end users have in speaking the language of computers," explained Tom Pyke, chief of the Computer Systems Engineering Division, in which the NBS networking program resides. "We have developed a minicomputer-based Network Access Machine (NAM) which executes complex network procedures in response to simple user commands."

Because NAM is implemented on a separate minicomputer, it can be used to access resources on many different networks, conforming to the unique protocols of each. The system is in experimental use within NBS and will be replicated soon for use by other groups.

Comshare TEC Corrects Errors For T/S Systems and Terminals

ANN ARBOR, Mich. – A hardware device from Comshare, Inc. reportedly provides error-free output from all Comshare time-sharing systems to asynchronous terminals operating at speeds up to 1,200 bit/sec.

Dubbed the Telegrid Error Controller (TEC), the hardware device is described as the first of its kind to extend error-detection capability to the terminal. Until now, according to the vendor, intelligent time-sharing networks performed error-checking functions only as far as the remote city node without addressing the problem of "local loop" communications reliability.

With the development of TEC, the user is assured his data is error-corrected at every point through his Bell local dial-up facilities right to the terminal, Comshare claimed.

The 1,200 bit/sec terminal user with TEC can reportedly utilize up to 60% of the speed of a 2,000 bit/sec terminal plus 100% of its error-control features at approximately 30% of the cost.

TEC costs $50/mo on a one-year lease. The purchase price is $1,500 per unit, with a monthly maintenance charge of $5.

Rental customers may accumulate purchase option credits at 50% of paid rentals, the firm said from 3001 S. State St., 48104.

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CRT Option Monitors Intershake Testers

ALEXANDRIA, Va. – Atlantic Research Corp. has introduced a CRT monitor option for its Intershake line protocol simulator and tester.

The CRT allows visual text display of data messages and control characters. By using Intershake to activate and freeze the display of those characters or data blocks of interest, the capability of the 512-character screen is "magnified" to the equivalent of several thousand characters, the company said.

The CRT plugs directly into the parallel interface port already existing on all DTM Intershake units without requiring any modification. It is available in either rack-mountable or portable versions, Ascii or Ebcdic and with switch-selectable 115V/60Hz or 230V/50Hz power.

The Intershake CRT-DTM Option 18 is a programmable online monitor. It will display all transmit and receive data or can be programmed, via Intershake, to display only selected transmissions. It can display only the response of a selected terminal, display only the transmitted polls, display only protocol characters or display only received or transmitted text.

The user can freeze and display the last 512 characters after a selected event or error. When used off-line with Intershake, the CRT-DTM provides a CRT display for either simulating or testing a terminal.

The CRT costs $1,950 with 30-day delivery from 5390 Cherokee Ave., 22314.

Micom Controller Features Micro

CHATSWORTH, Calif. – Micom Systems, Inc. has introduced the PCC 50/40 programmable communication controller, which incorporates a microcomputer.

The central control module contains all system elements necessary for an operational system including an 8K-byte memory, real-time clock, auto restart timer, I/O ports and microcomputer.

The microcomputer features vectored multilevel interrupts, unlimited subroutine nesting and direct memory access. Memory expansion is available to 64K bytes.

Asynchronous communication line interfaces are available with controls for use in many applications, including auto answer. Full displays of control lines and data with light-emitting diodes are provided on each module.

Interfaces include both RS-232 and CCITT V.24 synchronous at speeds up to 19.2 kbit/sec and asynchronous to 9,600 bit/sec. Optional modules permit interfacing to 20mA or 62.5 mA telegraph current loops, MIL-188, CCITT V.35 interfaces or Bell 302 and 801 series data sets.

The basic PCC 50/40 is priced at $2,000. Communication line interfaces are approximately $250/line. Micom is at 20426 Corisco St., 91311.

Digi-Log Brings Out Briefcase Telecomputer

HORSHAM, Pa. – Telecomputer II, a briefcase CRT terminal, is available from Digi-Log Systems, Inc.

Standard and optional features make Telecomputer II interchangeable with Teletype models 33 and 35.

The terminal replaces the earlier models 209 and 33 portable interactive CRT terminals.

Expanded features include switch-selectable 40- or 80-character line length by 16 lines per display, for a total of 640 or 1,280 characters; built-in EIA RS-232 and current loop (20 ma and 60 ma) interfaces; and 15 switch-selectable rates, from 50- to 9,600 bit/sec.

Additional features include an optional built-in coupler and modem with switch-selectable transmission speeds of 10- and 30 char./sec and a 64-character Ascii code set.

Price for the basic terminal is $1,295; with acoustic coupler, 5-in. CRT and case, the price is $1,795. Lease programs are available and delivery is off-the-shelf from Babylon Road, 19044.

Data Set Runs at 9,600 Bit/Sec

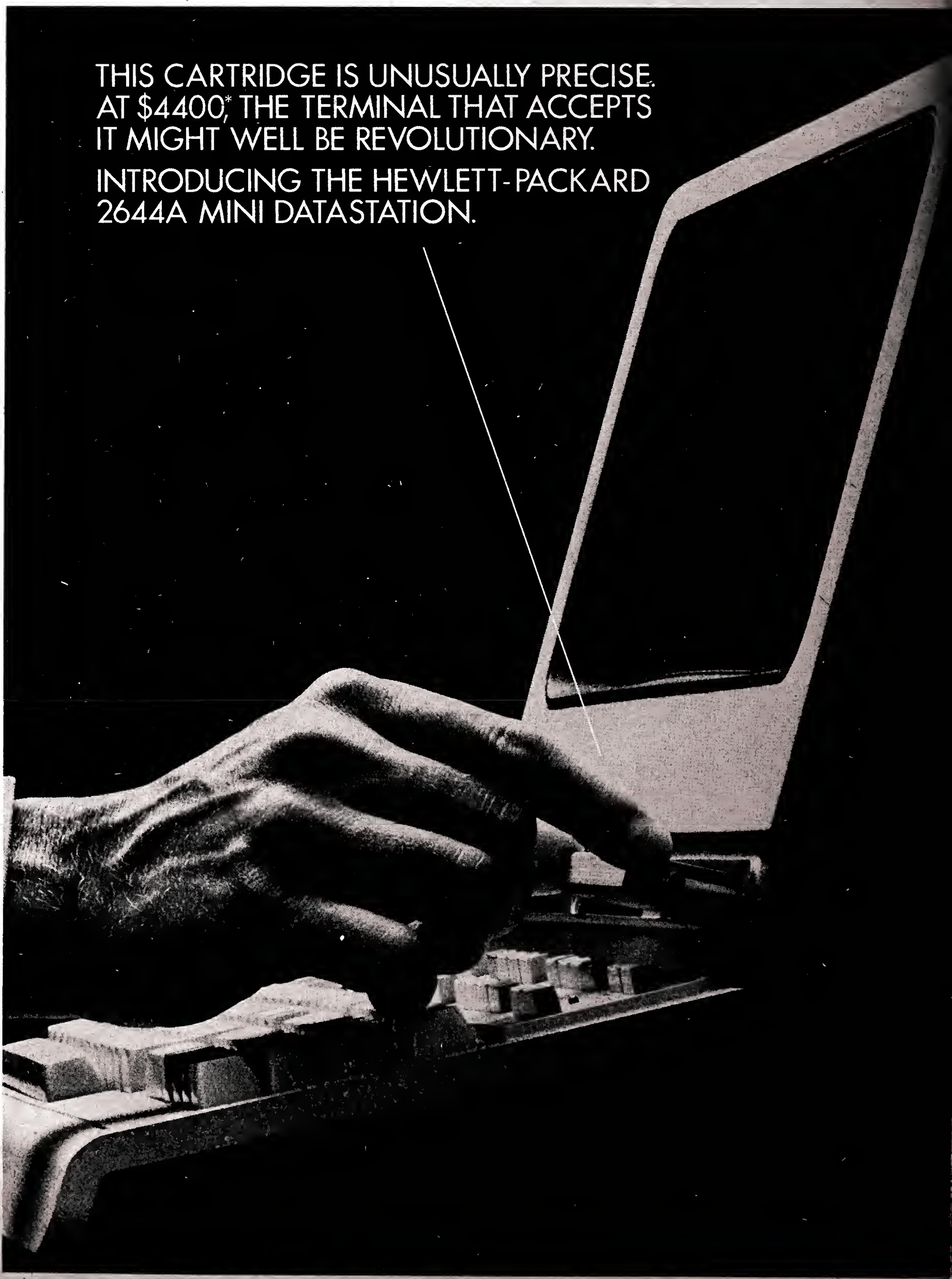
WILTON, Conn. – General Datacomm Industries, Inc. (GDC) has introduced a 9,600 bit/sec solid-state LSI data set.

The GDC 9600 data set is designed for operation on basic 3002-type private lines. It also provides for dial backup at 4,800 bit/sec over the dial-up network.

The data set is an all-digital implementation of advanced VSB modulation and equalization techniques using MOS-LSI and TTL circuitry.

The 9600 data set provides selectable 9,600-, 7,200- or 4,800 bit/sec serial, synchronous operation on unconditioned 3002-type private lines. It can operate with or without D1 conditioning. Standard features include clear-to-send delay, carrier detect, external/internal transmitter timing and mark hold on received data when carrier is lost.

The modem costs $7,900 with delivery in 30 days from 131 Danbury Road, 06897.



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Distributed Processing Net Stretches Across Atlantic

Terminal Transactions

COLUMBUS, Ohio – Industrial Nucleonics here has developed an unusual distributed data entry and processing network of Sycor Model 340 intelligent terminals which gives the corporation both local control of input and a centralized data base.

The data is input locally in Belgium and transmitted over voice-grade lines to an IBM 370/145 in Columbus for processing.

"The move to trans-Atlantic transmission was precipitated by the company's increasing level of overseas business," according to Frederic Rieger, manager of the methods department for the Ohio-based manufacturer of computerized process control systems.

"What at first was an acceptable charge for outside computer services became less acceptable as new systems were planned," he said.

More Economical Overall

When Rieger and his staff began the project early this year, the cost of computer processing time in Belgium was more than twice the comparable service in the U.S. Even at $3/min for communications facilities, Rieger reasoned, to transmit the information to Columbus for processing was more economical. It takes approximately 14 minutes to send a cassette tape of 1,400 80-byte records at 2,400 bit/sec.

Amortizing the purchasing price of the Model 340 terminal over a five-year period and adding in the cost of transmission time (but not including the cost of processing which is considered a nonincremental expense), Industrial Nucleonics found the cost could be contained well within the monthly overseas DP budget of $1,500, Rieger said.

As more applications are added to the system, it will become even more cost-effective to lease a low-speed Telex or higher-speed alternate voice-grade data line, he said. That way, regardless of the usage, the cost will remain constant and considerably under that of price-per-minute transmission which the company is currently using.

No Loss of Control

Besides the prospect of saving money, Rieger believes his company has developed a workable data base without violating local control.

"And, because we are developing all the programs here and all the data is processed by the same system, we can better control the direction of our applications," he noted.

The company first tested the network in February with a Model 340 in Columbus and a Sycor-compatible terminal in Brussels. The test included an International Communications Corp. 2,400 bit/sec modem over standard dial-up telephone lines into Western Union International's Datel network.

Rieger attributed much of his company's success with the system to the state-of-the-art technology of the Belgian communications facilities. When minor transmission problems did occur, he added, they are usually overcome by the modem or the terminal's intelligence and its binary synchronous procedures.

The system has been operational since mid-October and performs all billing for rental, service and installment contracts on the stand-alone Model 340. It factors in terms and conditions on different agreements, totaling the value of any parts used, adding service charges and taxes and printing out invoices – items that were previously calculated manually.

Centronics Adds 300 Bit/Sec CRTs

HUDSON, N.H. – Centronics Data Computer Corp. has added two telecommunications products – the models 330 and 530 teleprinter terminals – for 300 bit/sec users.

Both models provide 300 bit/sec throughput, 9 by 7 dot matrix character formation, elongated characters (boldface) for report headings and highlighting which carries through on multiple-part forms, parity error checking and adjustable tractor feed.

In addition to these features, the Model 530 provides wider forms capability (up to 14-7/8-in. wide) and 132 print positions. For the user who requires 132 print positions and can use 9-1/2-in. forms, a condensed print option on the Model 330 allows him to use the 330 at a lower price and still benefit from the 132-character line length.

The 330 and 530 teleprinters are available in receive-only (RO) and keyboard send/receive (KSR) configurations only.

The end-user prices for Model 330RO and 330KSR are $2,505 and $2,790 respectively. The Model 530RO and 530KSR cost $2,740 and $3,020 respectively.

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Savings May Reach $250,000

User Exchanges Saturated 370 for Less Costly 360

By Patrick Ward
Of the CW Staff

NEW YORK – "Money" was the simple reason the National Maritime Union's Pension & Welfare (P&W) Fund replaced its IBM 370/135 with a 360/40, according to John Reeps, operations manager.

When its rented 96K 370/135 became saturated, P&W decided the enhancements IBM advised would just cost too much money. So P&W returned the 370 and bought a 256K 360/40.

The move may save P&W as much as $250,000 over a three-year period, based on the 370's cost *before* enhancements, Reeps said.

P&W had been an early 370/135 user, first renting the machine from IBM in late 1973. The $15,600/mo computer ran varied batch applications and used IBM's Customer Information Control System (CICS) to handle on-line inquiries from four IBM 3270 CRTs.

But "it turned out the system wasn't big enough for the job," Reeps said.

IBM proposed adding another 48K and replacing the system's three 2319 spindles with two 3340 drives. The changes would have added about $2,500/mo to P&W's rent, a prospect that dismayed Reeps.

And the IBM proposal presented another problem. To accommodate the changes and continue running CICS, the shop would have had to abandon DOS Release 26 and convert to DOS/VS.

Alternatives Researched

P&W decided to look a little further. Leasing a 370 from a third party was one alternative but, at the time, third-party lessors wanted five- to seven-year contracts on 370s. P&W did not want to make that long a commitment.

The next thought was a 360/40, Reeps recalled. He had worked with one before and liked it. P&W also used a 30 before the move to the 135. Since his organization's workload was relatively stable, Reeps felt a 40 could handle the job.

P&W talked with about a dozen vendors who offered two- and three-year lease plans on 40s. Some of these lessors offered systems that cost $6,000/mo less than the 135, Reeps said.

After some further calculation, however, P&W decided purchasing would be more economical.

"We felt the value of [the 360/40] wouldn't fall that much in three years," Reeps said. "And if we owned it we could depreciate it."

P&W chose to buy the machine from Talcott Computer Leasing. "The price was competitive. Talcott had its own software people, and it is connected with the Computer Lessors Association [CLA], which gives some support under DOS," he said.

The Talcott package included a 256K CPU, a 1403 N1 printer, a 2540 reader punch, 2401 tape drives and eight spindles of 2314 disks.

Weekend Switchover

The switch from the 370 to the 360 took place over a weekend a year ago. The shop had about 95% of its applications operational by the following Monday.

Only one presented a problem. Talcott people eventually traced it to a CLA fix "that wasn't completely successful," Reeps said.

P&W found little real throughput difference between the 135 and the 40. While the 135 was faster, P&W applications are predominantly I/O-bound and the CPU speed doesn't make that much of a difference.

Bringing in the slower 360/40 meant "perhaps a 5% to 8% increase in the time required to do a week's work," Reeps estimated.

The 360, however, offers P&W the additional core and disk to handle growth, he noted.

The shop decided to switch from CICS to Westinghouse's Westi communications monitor about the time it changed mainframes, Reeps said. "We feel [the Westinghouse product] is more appropriate to our size and less core-expensive," he explained.

Westi occupies 24K in the 40, half as much as CICS took on the 135, he said.

As for keeping up with technology, Reeps feels his company's workload is stable enough and the 40's growth capacity large enough so the need for a new CPU will not arise for quite a while.

Drum Alternate, 158/168 Memory on Way

NEWTON, Mass. – Add-on memory manufacturers are considering making core or semiconductor equivalents to IBM's 2305 fast-access drum, according to interviews with several vendors.

Many memory vendors also said they plan to introduce semiconductor add-on memory for IBM's 370/158 and 370/168 in the coming year.

The IBM 2305 is typically used to provide a page-swapping area in virtual memory sites. It can also store frequently used utility software and perform buffering and queueing tasks, according to a spokesman for Intel.

However, "the price/performance of the 2305 hasn't been great," the spokesman said. A core or semiconductor product would have much higher performance and reliability for about the same price, he said. The other memory vendors agreed with him.

Some users could expect that a 2305 device might bring a 20% system throughput gain to their sites, the Intel spokesman said. The gain would be in the 10% area if the user already had been using a 2305, he said.

The advantage of this type of device over the alternative of putting more add-on memory onto a computer system is that the 2305-compatible box could provide five times as much storage for the same price, the spokesman said.

However, these throughput benefits would vary considerably among different users, he noted.

Intel is "halfway between considering and announcing such a product," the spokesman said.

EMM Computer Products is also evaluating the possibility of a 2305 replacement, but has not decided one way or another, according to Wayne R. Brumm, product manager of the systems equipment operation.

But a drum replacement is "very definitely coming from Ampex next year, according to Al Sroka, manager of the company's Memory Products Division.

IBM 370/168 users can expect to find Intel offering semiconductor add-on memory for that machine in the second quarter, the Intel spokesman said.

EMM sees 168 add-on memory as a definite possibility for late 1976, Brumm noted. That company plans to announce semiconductor memory for the 158 about the end of this year.

EMM will also bring out 370/135 add-on memory toward mid-1976.

"We're looking at offering a product with a 2M-byte capacity – four times the IBM limit," he said.

EMM is also evaluating field enhancements that would boost the speed of 360/65 and 370/155 add-on memories by 10% to 15%, he said.

Asked why users typically resort to add-on memory, the vendors tended to point to IBM's Customer Information Control System (CICS), and to VS.

"We love to see a user go to CICS because very shortly he will pick up more memory," the Intel spokesman said.

VS, with its paging requirements, also leads a lot of users to add more memory, Brumm remarked.

Itel Has 168 Add-On Memory

SAN FRANCISCO – Itel Corp. has brought out an IBM 370/168 add-on memory for end users.

The Itel 168 Monolithic Main Memory (MMM) uses 4K random-access memory (RAM) chips that are said to reduce the number of components per memory size and provide "superior reliability."

Starting from any IBM memory size, Itel's 168 MMM can be added in 1M-byte increments to a system total of 8M bytes.

The 168 MMM is fully compatible with IBM 370/168 Model 1s and Model 3s and multiprocessor models, Itel said.

Although an Itel spokeswoman said pricing is not yet finalized, she predicted the memory will cost "from 10% to 50%" less than the IBM list price.

First shipments of the memory are set to start in January from the firm at One Embarcadero Center, 94111.

CDC Plans Larger, Upward-Compatible Machines

ATLANTA – Control Data Corp. users can continue to expect new and larger mainframes from their vendor.

That was the gist of remarks John V. Titsworth, CDC executive vice-president, made at a recent users meeting here.

CDC will continue to focus on building computers for large engineering and scientific users, he said.

The company is working on development of standard product lines, with particular emphasis on maintaining operating software that will be compatible with currently available CDC machines, he added.

CDC's plans call for systems that can perform 20M to 60M floating-point operation/sec, a rate five to 10 times faster than that which today's top-of-the-line Cyber 76 model can offer, Titsworth said.

These machines will "meet ever-increasing user requirements for better data management capabilities, input/output controls and faster and larger computational facilities," he said.

"We have placed highest priority on developing a technically simple and economic migration path to new systems," Titsworth said. "A file system common to standard systems and computational facilities and new systems product lines is receiving special attention."

Top 170 in the Works

CDC is in the final development stage of a project that would place a 7600-class machine at the top of the company's Cyber 170 line, Titsworth said.

The 7600, a large-scale system typically used in engineering and scientific environments, is twice as powerful as the current top-of-the-line 170 series models, a CDC spokesman noted.

The model CDC is planning would fill the gap between these model lines, the spokesman said.

CDC also has enhancements to its Star system under way, Titsworth said. The Star, used in "extremely large engineering and science environments," has a bandwidth of 1.6G byte/sec, compared with the 383M byte/sec bandwidth of the CDC 7600, he said.

"In addition to new semiconductor memory and other changes to improve [Star] performance, we are implementing a Cyber 170 front end for Star," Titsworth said.

The front end will handle conventional DP, leaving the Star free to concentrate on the types of problems it can handle best, Titsworth concluded.

Broomall Graphics Systems End Need to Exhibit Step Functions

BROOMALL, Pa. – The 930 series of graphics systems from Broomall Industries is comprised of continuous rather than incremental computer/plotter systems that can draw straight or curved lines without exhibiting step functions.

Data base creation, maintenance and overall system operation are handled by the systems' integral processor, Broomall said.

A full range of peripherals includes input modules such as magnetic tape cassettes and other tape units, punched cards, paper tape, digitizers, CRT devices and a teletypewriter.

Applications include charts, maps, plots, plant design, conversion, highway design, graphs, network layout, schematic drawings, printed circuits and layouts, Broomall said.

The system can be expanded to include multiple plotters, batch processing, foreground/background operations and real-time processing, Broomall said.

A software library, mostly based on Fortran programs, is available.

The System 930/100 costs $59,000. The System 930/200, with a larger plotting area, costs $75,800. The prices include plotter, computer and basic software and hardware.

Broomall is at 682 Parkway, 19008.

First MSS Seen Economical for Large-Scale Users Only

By Patrick Ward
Of the CW Staff

REDWOOD CITY, Calif. – Only large-scale mainframe users will find the first commercial mass-storage systems (MSS) economical, but, in these shops, these systems will be able to cut both batch and on-line processing costs, according to Erik Salbu, mass storage systems marketing manager for Ampex Corp.

Ampex plans to begin shipping its Terabit system to commercial users early next year. The device offers from 11 billion to 350 billion bytes of storage and wili interface IBM 370/155s and up under either OS/MVT or virtual operating systems. The Ampex device also interfaces Control Data Corp. (CDC) 7600s and 6600s and Digital Equipment Corp. Decsystem 10s.

Less expensive mass storage units for the 370/145-level user are about two years away, Salbu predicted.

How will mass storage save the large-scale users money? Consider that the typical buyer will have 4,000 to 5,000 tapes in his library, Salbu said.

"In that type of batch-processing environment, mass storage is really a tape library replacement and can be cost-justified as such," he said.

Users currently spend about $2/tape mount, with about a third of the cost in tape drives and controllers, a third in operators and a third in tape library facilities and management, he said.

If the typical shop mounts about 10% of its tape library/day, the user with 5,000 tapes spends $1,000/day or $30,000/mo on his current system, Salbu said.

With that amount of money, the user can buy a mass storage system and avoid handling errors and delays and improve security, Salbu said.

But mass storage systems can also double as a vehicle for on-line data base applications, Salbu added. Interactive users can switch a percentage of their on-line files from disks to lower cost, lower speed mass storage, he explained.

This could be especially appropriate in a shop handling interactive applications under IBM's VM/370 operating system, he said.

In this case, the data center may be keeping up to 20 times as much data on-line as its terminal users require at any one time, Salbu remarked.

Rather than storing every interactive user's data base on disk, the DP center could program the mainframe to bring the data base from mass storage while the interactive user was logging in, he said.

Mass storage is too slow to have much of an impact on an interactive, IMS-type data base that supports a wide range of terminal users, he said. It can, however, serve as a dump/restore facility for that user, he said.

Honeywell TDC With Micros Controls Industrial Processes

FORT WASHINGTON, Pa. – Honeywell's Process Control Division has introduced a control system architecture – Total Distributed Control (TDC) – that is said to have the design flexibility to handle industrial processes of any size or complexity.

Called the TDC 2000, the system integrates microprocessor controllers, stand-alone CRT stations and a coaxial cable "highway" for information transfer.

More than $1 million can be saved in installing a large system since "miles" of wiring are eliminated through use of the coaxial cable, Honeywell estimated.

The basic element of TDC 2000 is a digital controller using microprocessor technology. The controller is configurable on-line by push-button to perform any combination of eight control functions from 28 equations.

Conventional operator interface can be obtained with a complete range of panel-mounted analog displays. A keyboard on the data entry panel provides displays for interrogation and configuration of the controller.

The operator station also uses a microprocessor and makes available all control information on a CRT display. The station may be used as a stand-alone display or as part of a centralized control console.

When higher level digital and supervisory control are needed, either of two process computer systems – HS716 and HS4400 – with appropriate Honeywell software support are available.

Data acquisition is provided by a process interface unit which communicates with the computer over the data highway and can be located up to 5,000 feet away from the highway traffic director.

TDC 2000 system prices begin at $15,000 from the firm at 1100 Virginia Drive, 19034.

Tab Products Designs Floppy Storage Units

PALO ALTO, Calif. – Tab Products Co. has introduced two storage alternatives for floppy disk users.

The Hang/50 storage module is a filing suit that suspends up to 50 floppies in plastic jackets attached to metal hangers. This keeps each floppy in a straight vertical position, preventing warp and sag that can lead to wear problems, Tab said.

Each jacket is indexed. The Hang/50 module itself is lockable, Tab noted.

Tab plans to ship its own floppies to users in a two-ring binder with protective vinyl sleeves for each disk. Called the Flip-Floppy, the package holds up to 10 floppies and includes index cards and a sequential numeric/color coding system.

The Hang/50 storage module costs $74.50. The Flip-Floppy binder, sleeve and coding system costs $14.95 (without diskettes) from the firm at 2690 Hanover St., 94304.

Correction

Further information on the IEEE Computer Society's second mass storage workshop [CW, Nov. 5] is available from the chairman, David N. Freeman, at Ketron, Inc., 530 E. Swedesford Road, Wayne, Pa. 19087.

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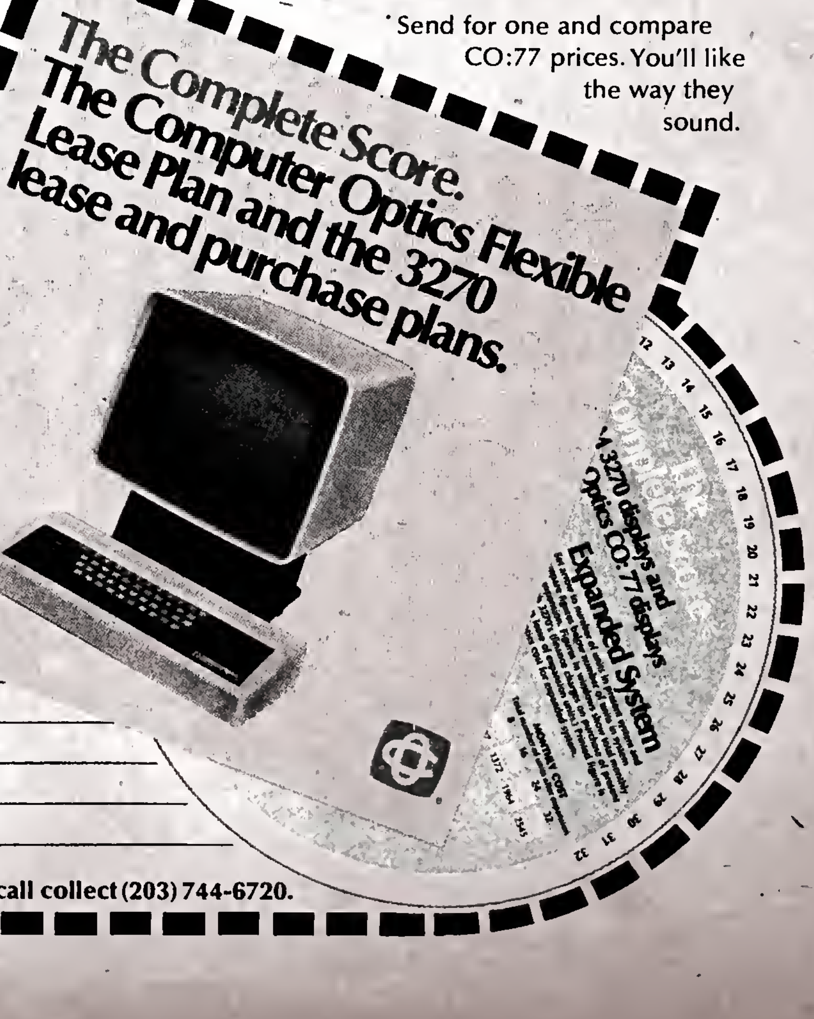
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For Products With Fluctuating Demand

System Balances Firm's Manufacturing, Marketing

By Harry B. Solmson

Special to Computerworld

Special problems exist in the proprietary medicines, toiletries and cosmetics business – problems of fulfilling widely fluctuating market demand requirements on hundreds of diverse products with similarly fluctuating inventories.

To meet these special problems, Plough Inc. has set up on-line computer systems that are helping control the handling of customer orders, production and inventory, while making each responsive to the other.

This problem of balancing marketing and manufacturing is especially acute for several reasons. For example, many of Plough's products – like Coppertone, Sudden Tan and Solarcaine – are seasonal in nature, requiring high production and inventories only during certain times of the year.

The on-line computer systems have helped company sales volume rise and have helped bring the inventory-to-sales ratio down at least 15%.

Customer service level is higher and order turnaround time is shorter. Cost savings from reduced inventory investment and more economical production scheduling are substantial.

The key to the DP contribution is a data base approach coupled with on-line communications techniques. "The data base provides the central repository for data essential to the operation of the business and a common information source serving management and operating personnel at all levels and in all functions," John A. Meade, director of Information Systems, explained.

"On-line communications instantly updates the data base to reflect the current situation and makes pertinent, timely information readily available to whoever needs it."

The control computer for the on-line systems – an IBM 370/155 – is located at the company's Memphis, Tenn., headquarters and main manufacturing plant.

On-line to the computer for both data update and information retrieval are some 40 3270 CRTs.

These are located in several departments: order entry, shipping and receiving, credit and customer service, inventory planning and production scheduling, purchasing, package engineering, research and accounting.

In addition, IBM System 3s are on-line to the central computer at each of the Plough distribution warehouses in Memphis, Miami, Los Angeles, Chicago and Carteret, N.J.

Critical Systems

The most critical on-line systems, in terms of contribution to manufacturing and marketing balance, are the inventory and production control system and the order entry system.

Several files in the on-line inventory and production control system are major segments of the Plough data base – principally the open-order file, the inventory file, . the bill-of-material file and the production standards file.

In effect, the open-door file tells inventory planners what current product requirements are.

This file lists stock on hand and committed at each of the five Plough warehouses. It also shows product movement history during the previous 24 months, forecasted demand and scheduled production for the next 12 months and the finished-goods allocation plan for the upcoming 30 days – all by one of 11,000 stock-keeping unit numbers.

After production items and quantities are determined, the bill-of-material file tells inventory planners how to make and package the needed products.

"Fresh information flows into the data base via the 3270 terminals as transactions occur," Meade explained.

"Order entry, for instance, updates both current product requirements and on-hand, committed and available inventory data. Changes in sales forecasts update the forecasted product demand data, and the release of new production orders updates scheduled production data.

Purchase order issuance updates materials-on-order data. When a product allocation moves to a warehouse from the plant, receipt is entered immediately via the terminal in warehouse receiving.

When a shipment moves out of a warehouse to a customer, the shipping notice is entered via a terminal.

Drawing upon the data base record files, the central computer produces what amounts to a weekly "position paper" showing product requirements vs. inventory availabilities.

In addition, the computer produces a weekly requirements plan, exploded through all bill levels, to show what is needed, how much and when at every level of production.

All orders (averaging about 1,000 a day) come into Memphis headquarters and are entered on-line, as received, via the central order group's 3270 terminals.

Depending upon the particular order requirements, the terminal operator simply hits a code key to call up a visual screen display of all items within a particular product line.

Running down the screen display, the terminal operator simply keys in the order quantity adjacent to the appropriate item. He does not need to enter any product identity, only the quantity needed.

Updates Records

Once it accepts the customer, item and quantity entry, the system updates related file records – on the customer, order and inventory files, adjusting requirements and availabilities by finished product and through the various bill levels.

When a customer order leaves the warehouse, notification of shipment is transmitted back from the warehouse System/3 to the headquarters computer.

Also, the central computer will follow up on any order status where notification of shipment does not come back within 48 hours.

Solmson is president of Plough, Inc. in Memphis, Tenn.

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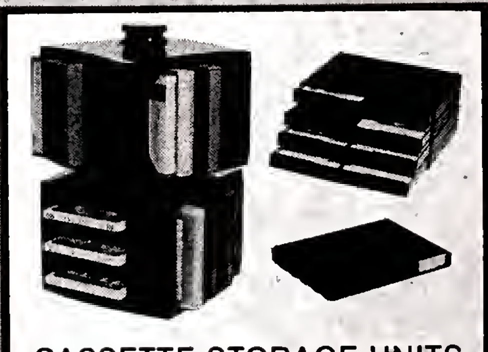

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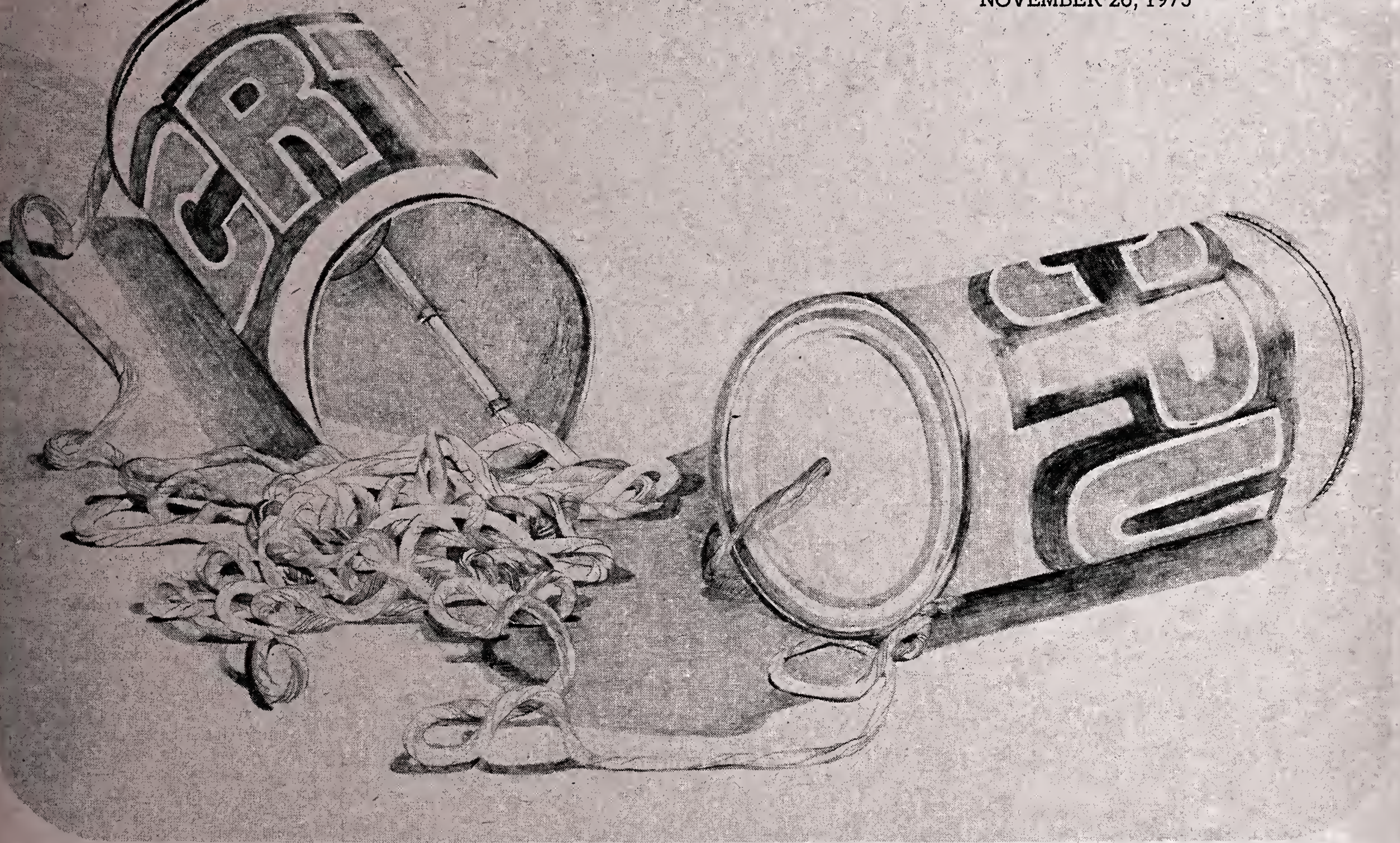
Unraveling Data Networks

A Computerworld Special Report

NOVEMBER 26, 1975



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This special report was prepared under the direction of Ronald A. Frank, CW associate editor/technical news. Cover art by Cynthia L. Kintzer.

Within Past Six Months

Data Communications Options Continue to Proliferate

By **Dixon R. Doll**

Special to Computerworld

Within the past six months, many of the traditional promises of new services for users have become reality.

Domestic satellite channels from Western Union, American Satellite and RCA are now being employed for various data communications applications. Also the value-added carrier networks have begun operation with the initial service from Telenet Communications Corp.

Specialized carriers like MCI Telecommunications Corp. and Southern Pacific Communications continue to expand service to data users with traditional analog offerings using modems, on the one hand. On the other hand, digital switched services from Data Transmission Corp. (Datran) are now being used with increasing regularity.

In addition, users are now in a position to plan for Bell System Dataphone Digital Service (DDS) with certain specific price advantages and a larger number of geographic locations for service. This is in spite of the confused two-tier DDS pricing structure "temporarily" in effect.

Many design alternatives which were only available on paper as recently as a year ago have started to become a reality. The traditional approaches to configuring a network must now be blended with new and complementary procedures for designing networks which contain a mixture of both the traditional and more recently available services.

As an example, consider the value-added carrier offerings. The user who is now involved with designing a leased-line network and operating it and maintaining it turns over full responsibility for those functions to the value-added carrier.

From the user's standpoint, there is no further worry about minimizing line costs, assuming the value-added service provides coverage to all user locations.

In the next year or two, most users will want to get their learning curve established on a reasonably low-risk basis. For example, many companies are considering the use of individual DDS lines, individual specialized carrier lines, individual satellite channels or a small amount of packet-switching service as a way of initially understanding the impacts of such services on their existing networks. As the users develop a familiarity with the differences in these new services, they will make decisions to either expand the realm of coverage or to terminate the service altogether.

One of the problems the user must face is a decision regarding the best blend of traditional services and the new services (satellite, DDS, specialized carrier and value-added carrier) which will be of most significant benefit to him.

To be sure, most users will not be able to justify using all of them. The problems of dealing with half a dozen carriers will tend to increase the administrative burden to the point of diminishing returns in comparison with dealing with perhaps only two or three vendors whose services provide the greatest networking benefit.

User-Sensitive Pricing

Users are also increasingly concerned about using traditional services with usage-sensitive pricing structure such as Direct Distance Dial. Many of them got burned very badly in March of this year when the Bell System changed its pricing structures significantly.

Continued reliance upon traditional services, especially those in the monopoly area, will place the user at the mercy of the vendor offering such service. Also, it will give the user virtually no predictability in the cost of operating his network.

The value-added carriers, of course, have a usage-sensitive element of their pricing structure which must be considered. However, for the next year or two it would appear that most users will need to be most concerned about the fixed costs of initially establishing a relationship with a value-added carrier.

The value-added carrier service offering will have a pricing structure which depends on the following rate components:

- Any local distribution charges for connecting the user terminals to the value-added carrier's minicomputer in the serving city.
- Any dedicated ports either dial or leased on that minicomputer for which the individual user must pay.
- Costs for access line to host computers.
- A connect charge in cases where dial-up access is made from user terminals into shared public ports in the value-added carrier offices.
- The usage-sensitive element known as the packet charge.

Obviously, the correct way to approach the evaluation of such an offering will be to objectively compare all of the appropriate rate elements for using a packet-switching system with the current alternatives based on other approaches.

Applications Trends

An increasing number of users now want to consolidate multiple applications onto the same physical communication lines. For example, many users operating some type of data collection or remote job-entry (RJE) batch network are finding more and more ways to overlay their on-line requirements in the same physical communications network.

This has to a great extent been accomplished using hardware devices such as split-stream modems and multiplexers to allow individual physical lines to provide more than one independent channel to these various applications.

(Continued on Page S/6)

Bell's Claims for DDS Unsubstantiated

By **David L. Lyon**

Special to Computerworld

If the Bell System is right, Digital Dataphone Service (DDS) is the best thing to happen to data communications since telephone lines.

According to the people at Bell, DDS is cheaper than current analog service (modems and voice-grade lines) and offers communications users better performance as well.

Organizations such as the Independent Data Communications Manufacturers Association (IDCMA) and officials at Data Transmission Corp. (Datran), one of the independent carriers, have taken exception to these claims. Both groups have filed formal objections to Bell's performance claims and pricing policy before the Federal Communications Commission (FCC).

Amid the charges and countercharges, one thing is painfully clear: Now is not the best time to run out to your computer room and unplug your modems.

The Bell System is working hard to make DDS seem less expensive than analog service. The fact is, however, the actual tariffs may not be settled for years.

Currently in the thick of a legal tangle concerning DDS tariffs, the FCC is making Bell add new cities to its DDS under the existing tariff for private-line service (Tariff 260) at rates comparable to those charged for analog services.

Tariff 267, the current DDS tariff, now applies only to the original five cities of the DDS network. (That means DDS isn't chaper than analog service in most places and may never be).

Moreover, the FCC is studying Bell's overall pricing and claims by the Bell System that DDS is a new, distinct class of service. No firm decisions are expected before the beginning of next year. Even then, dissatisfied users or competitors may file suite in a federal district court to block the new tariffs and further delay a pricing decision.

As regulation piles on regulation and the legal smoke thickens, it is interesting to analyze the cornerstone of Bell's pricing policy: the incremental cost of using Data Under Voice (DUV) signaling over analog radio links. Using incremental costing, the DDS rates go up only when the cost of equipment and services used exclusively for DDS goes up.

This pricing policy can make for some startling inequities (and awesome power to stifle competition), because DDS shares so much equipment and plant space with other AT&T services. Bell could effectively subsidize DDS rates with revenue from other AT&T divisions forever, if necessary.

Even if the incremental costing procedure is allowed by the FCC (in the face of some stern opposition) the question becomes: What happens when the relatively low capacity of the DUV channel is filled and Bell is forced to use the normal, "high-priced" frequency bands of the same analog radio links?

Will Bell automatically raise the price for such overflow service? Or will the Bell System prorate such higher cost service over the entire spectrum of offerings so all users share the burden equally? So far

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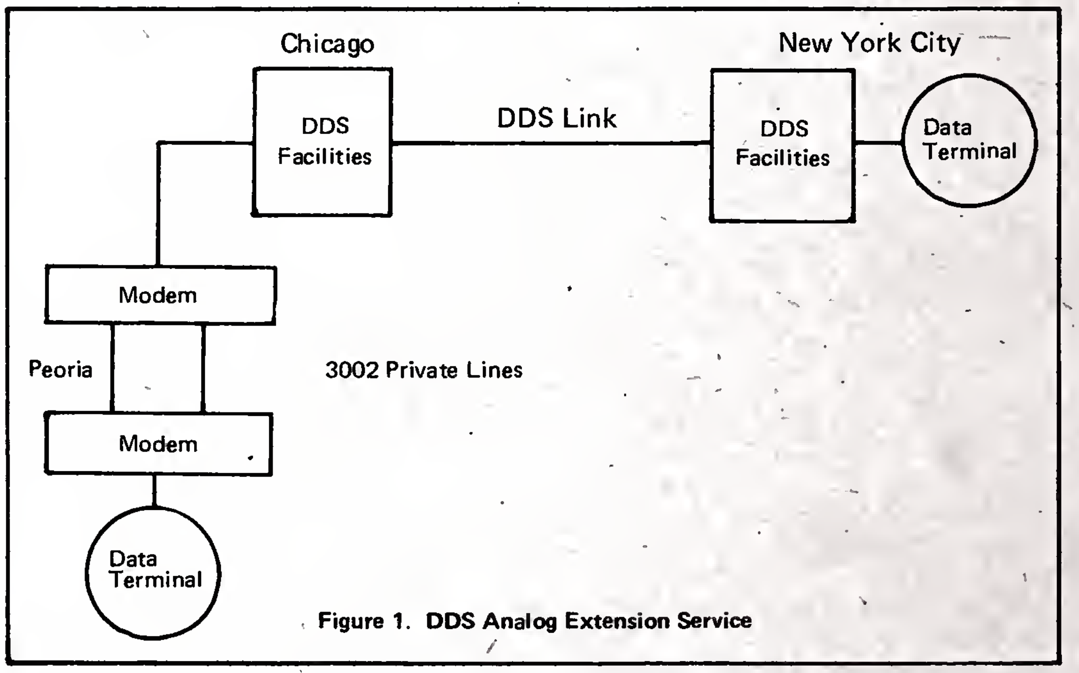

Figure 1. DDS Analog Extension Service

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Communications Standards Provide Plan for Future

By John L. Wheeler
Special to Computerworld

Data communication standards have a unique role compared with most standards in use in the world today.

While many standards, such as building codes, electrical safety and raw material dimensions, are a precise record of the way a certain function has been provided as a result of long use and experience, data communication standards instead provide a plan for the future.

Data communication systems, with requirements for complete and detailed worldwide compatibility, reliability and flexibility could never be built and made to operate without this plan for the future.

Data communication standards are different because they must be developed and agreed to before the first system is built and because they must be continually updated and improved through use and experience.

These standards are applied to digital data links and to networks, each made up of a number of data links and switching nodes.

There are two basically different types of data systems. One makes use of voice facilities specially adapted to carry data signals. The other uses purely digital facilities designed only for the transmission of data signals.

These two types of systems are quite different in the way the network is operated and controlled.

An analog or voice telephone network utilizes a distinctive dial pulse or dual-tone multifrequency (push-button) method for address signaling.

The data is transmitted through the network using either conventional or special modems, which adapt the data signals to match the analog characteristics of the network intended for voice communication. Thus, two completely different methods are used for network address control and for data transmission.

In a digital data network, the addresses of the called parties are entered into the system for address control in the same way as the data itself. The only difference between the network address control signals is the time at which they occur.

Because different methods are used for control of analog voice and digital data networks, the standards for such control are different. The basic functions and operations are the same, but the codes and signal characteristics are selected to match the need.

In either application, the network can be a private or dedicated facility made up of lines leased with a common carrier such as AT&T or Western Union for use by one customer with limited access, or the network can be a public facility with access offered to anyone who requests it and pays for its use. This distinction between private and public networks is not a technical one. There is very little difference in the compatiblity standards needed in each case.

An example of a typical data communication network is shown in Figure 1. It is made up of only three elements. These are user terminals, the links which carry signals between terminals and the nodes or switching centers which connect the links.

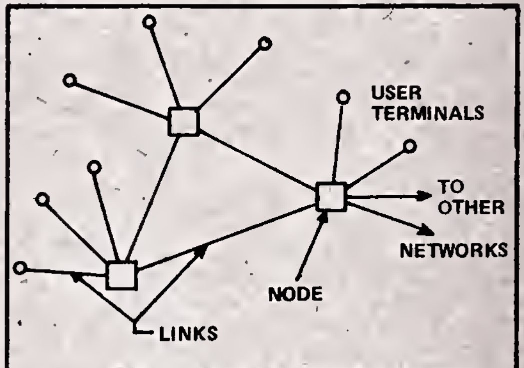

Figure 1. Data Communication Network

Two individual networks may be connected as shown in Figure 2. These may be two domestic networks in the same country or in two different countries.

(Continued on Page S/15)

Remote Processing Trend Responsible

Intelligent Terminals Fastest Growing DP Area

By David C. Seigle
Special to Computerworld

The intelligent terminal area has been one of the fastest growing segments of the industry. A driving force behind its growth has been the implementation of remote or distributed processing in user information networks.

In its broadest sense, distributed processing includes remote data entry as well as data manipulation; and, since the early 1970s, users have applied terminals to the data-entry aspect of remote processing.

Now more is being demanded of remote facilities, and intelligent terminals are becoming more sophisticated in their ability to process as well as edit and transmit data.

Because of the power of microprocessors to drive intelligent terminals, this processing power extends well beyond the device's capabilities to do editing normally associated with the data-entry function and considerably past simple input/output operations.

Resident software control can provide a multitasking environment in which concurrent jobs may be run. The software can, for instance, permit data entry to proceeed at the same time that files are being received and printed from the central processing unit.

By adding a disk drive, the user can enhance his data-entry applications by storing important data at his remote site and accessing and inserting that data into keyed records. He can also ensure the maintenance of his files or use the disks for inquiry/response applications, giving him, in effect, the power of a minicomputer-based processor.

This then represents the most sophisticated use of intelligent terminals in remote processing systems: as data entry or inquiry/response is being performed in the foreground, concurrent processing is taking place in the background, allowing communications, file maintenance or transfer or printing to take place without interfering with the terminal operator.

Although the intelligent terminal has the potential of filling a large role in remote processing networks, there are, of course, limits to its use.

The intelligent terminal is, after all, a single key-entry station which has the power to support various peripheral devices including random-access devices being used concurrently with data entry. This capability fulfills the needs of a remote site with limited data-entry requirements.

However, when a large number of single key-entry devices are required at a single site, intelligent terminals compare unfavorably with clustered key-entry systems on a price/keyboard basis. Also at such sites, the most advantage may be gained from terminals only when they have access to shared files for inquiry/response purposes or for current information lookup during data entry.

Moreover, the cost of unshareable peripheral devices such as magnetic tape drives, card readers, printers and even communications on a single display intelligent terminal limits the practicality of having multiple intelligent terminals at one remote site.

Clustered Systems

On clustered systems, the cost and use of these options may, of course, be shared. Even the printer can be shared by using multiterminal printer support which allows each display to interleave data blocks to one printer as data is being key-entered.

Another significant advantage of clustered systems is having files available locally to be shared among several op-

(Continued on Page S/8)

Study of Nets Proves Useful to Potential Users

By David C. Wood
Special to Computerworld

This article surveys eight packet-switching networks, identifying the capabilities provided by each and reporting the economic analyses, if any, which show the networks' cost-effectiveness.

The networks are characterized from the viewpoint of a potential user who might wish to access the network from a computer or terminal.

The user-oriented capabilities provided by the network are identified; requirements for interfacing the user's computer or terminal to the network are shown; and trade-offs of using the network are discussed.

This survey is not concerned with internal characteristics of the networks such as routing strategies and packet formats.

The eight networks surveyed are:

- Arpa Net, the Department of Defense's Advanced Research Projects Agency network in the U.S.
- Cigale/Cyclades, a French government-sponsored research network.
- CTNE, a network operated by the public carrier CTNE in Spain.
- DDX-1, an experimental network developed by NTT (the public carrier in Japan).
- EIN, the European Information Network, a joint research project among European countries.
- EPSS, the British Experimental Packet-Switched Service.
- NPL, the network at the British National Physical Laboratory.
- RCP, an experimental network operated by the public carrier in France.

Packet-Switching Systems

The prime existing example of a packet-switched network is the Arpa network which comprises a data communication subsystem and a collection of host computers which together make up a resource-sharing network.

The packet-switched local network at NPL addresses the same fundamental communication issues, but on a small scale. Those two networks have been in existence for some years and have largely inspired the numerous other packet-switching networks in various stages of planning and implementation. However, these networks vary considerably in their design and the facilities they offer to the users.

The common feature of all the networks is the employment of well-formatted, relatively short message units called packets. The CCITT defines a packet as "a group of binary digits including data and call-control signals (e.g., address) which is switched as a composite whole. The data, call-control signals and possibly error-control information are arranged in a

(Continued on Page S/15)

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In Six Months

Communications Carriers Continue to Proliferate

(Continued from Page S/2)

Also users are finding many new ways to increase the usage of existing communications lines both by using these lines more hours per day and also by operating them at higher speeds. In many cases, users benefit noticeably by finding ways to schedule usage of such leased lines in certain periods of the day in certain areas of the country.

Scheduling perhaps might mean that a line's capacity would be used for data collection during one portion of the day switched over to on-line activity when the data collection function is not being performed.

Also coming into the picture for the first time is the awareness by users of the impact of digital voice on their network planning activities. Many customers investigating the viability of the new digital transmission services are concerned about losing the ability for alternate voice and data transmission on such lines.

Vendors have been preparing for this by developing digital voice-encoding equipment which will enable voice conversations to be carried on over these all-digital lines. Voice digitization is in its embryonic stages, but it does appear possible that substantial capabilities will exist for digitizing voice signals at speeds approximating 4,800 bit/sec (and possibility even slower at degraded quality).

Here an extremely interesting possibility opens up that would enable a corporation to perhaps multiplex individual voice conversations on a digital line which might also be used for data communications.

This problem is a sharp contrast to the concerns of a few years ago when the game was to maximize the number of bits per second which could be transmitted over an analog phone line of fixed bandwidth.

In the future, the game appears to be shifting to maximizing the number of voice conversations which can be sent over a given bit/sec in a data channel. Most users spend nearly 10 times as much on voice communications as on data transmission services.

It is interesting to note that the Bell System currently digitizes many of its voice channels in portions of its long-haul network using T-carrier signaling. Here one voice conversation consumes 56,000 bit/sec transmission capacity.

The monthly revenue derived from a voice channel which has been digitized will range from approximately $1/mile between high-density locations to something approximating $3/mile for circuits on a low-density basis. On the other hand, if the Bell System were to take this 56,000 bit/sec transmission capacity and utilize it to provide capability for Series 800 (wideband data) service to 50 kbit/sec customers, the average amount of revenue generated would approximate something like $10/mile per month.

Users should be very concerned about monitoring the DDS and digital pricing structures and understanding the full impacts which voice digitization equipment will have in the future planning of minimum cost communications networks and their corporations.

The alert planner must begin now to exploit the increasingly nebulous distinction between channels used for voice and data transmission.

Networking Equipment Trends

In the past year users have been very actively employing a variety of hardware devices such as split-stream modems, advanced multiplexing and concentration equipment and digital bridges for modem and port sharing.

Split-stream modems have certainly come into their own as cost-saving devices that enable one physical line to service multiple independent applications at a distance from the computer center.

The independent companies have recently introduced powerful split-stream modems with selectable splitting mixtures. This enables one mixture of speeds to be derived during part of the day and another mixture of speed combinations to be derived during other parts of the day. This type of hardware device enables the user to deploy a fixed amount of leased-line transmission capacity in a flexible way that gives him the greatest return on his communication line investment.

Another very popular networking idea is the inverse multiplexing technique (such as Biplexers from Codex Corp. and Lineplexers from International Communications Corp. (ICC) which has appeared. Customers are finding such devices to be very attractive ways for providing cost-effective service when they require point-to-point speeds faster than 9,600 bit/sec.

Another interesting possibility exists with Biplexers and Lineplexers. That is the idea of having two lines (one of them for backup) which will both be productive in a normal situation. When one line should fail, the system will continue to operate but at degraded speed.

In network optimization, there are many more design options available to the user today than ever existed before. The mainframe vendors are introducing unified networking architecture strategies (such as IBM's System Network Architecture).

Users continue to read and hear of the benefits of distributed intelligence in designing cost-effective networks. They continue to be plagued by an inability to quantitatively evaluate the true benefits of distributed intelligence in solving their networking problems.

The key is how much function will a distributed intelligence provide at what cost! The only viable way to finding these answers is for the user to become self-sufficient in design tools.

The user must develop his own set of design tools which he can use to evaluate his own set of application requirements in a completely objective way, free of any particular vendor influences.

The familiar adage of "Let the common carrier design my network" has become a tired obsolete cliche which is heard with decreasing frequency these days.

Progressive users are setting up positive plans to acquire their own tools and

(Continued on Page S/14)

terminals

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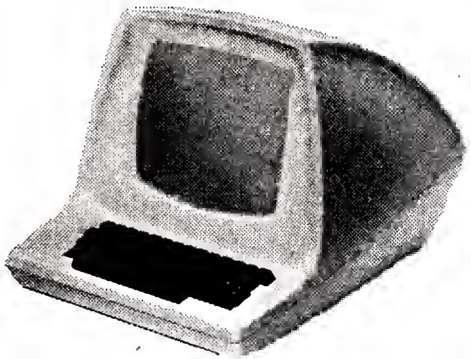

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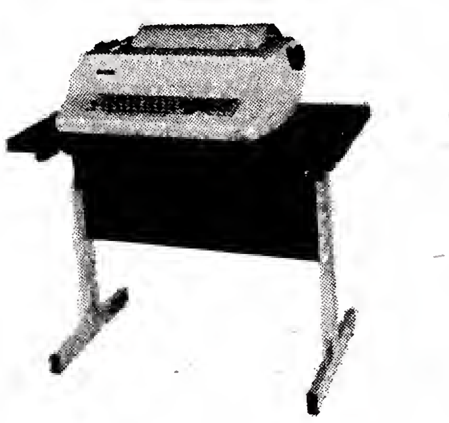

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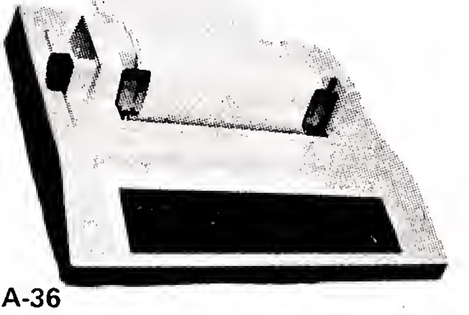

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Nets Make Reference Data Available in 50 Cities

By Mark Radwin
Special to Computerworld

Lockheed Information System's Dialog Information Retrieval Service provides access to a data bank of bibliographic and statistical information to users in North America and Europe, principally through value-added Tymshare, Inc.'s Tymnet and Telenet Communications Corp.'s data communications networks.

Dialog allows the user to interact on-line using the range of time-sharing hard copy or CRT terminals, directly with the Palo Alto, Calif., computer facility where over 7 million document references or statistical records are indexed.

The data bases, presently numbering over 30, cover major disciplines including areas in science and technology such as computers and control, chemistry, mathematics, physics, biology, agriculture and medicine; engineering disciplines; areas in the social sciences, business and finance.

There are several reasons why the utilization of value-added communication network services is essential to the offering of the Dialog service. The first is the wide domestic coverage. One network service which we have used for over 2-1/2 years, Tymnet, provides local dial access in over 50 U.S. cities. Almost all these cities generate too few connect-hours into the Dialog system to justify the costs of lines and multiplexers to serve them.

Another feature provided by the value-added networks, which is especially valuable to our operation, is virtual terminal support. This capability is provided by both Tymnet and Telenet in different ways, but Telenet's flexible approach in this area is particularly worthy of mention.

With virtual terminal support, the network provides very specifically tailored treatment of a variety of terminal characteristics such as transmission speed, character set (even allowing for minor differences between interchangeable type elements), carriage return and line-feed delays, full- and half-duplex operation, while allowing the host computer to handle these dissimilar terminals in a totally identical fashion, as if they all were Ascii-coded teletypewriters for example.

In addition to providing optimized treatment of each type of terminal equipment, Telenet allows the host computer to maximize the use of fewer total ports, using a single set of terminal support protocols with a minimum of host CPU and core overhead.

Telenet places control of around 20 terminal-related parameters in the hands of both the user and the host, with exclusive host control where desired, as well as default values internally established for a large number of terminals.

Users Have Choice

Dialog users have a choice of either paying a fee for using the value-added network service or directly calling Palo Alto telephone numbers. The user population is heavily weighted to the over-1,000-mile category so that direct distance dialing (DDD) costs tend to run close to the maximum $30/connect-hour.

Averaged total costs for providing Tymnet or Telenet communication network services with the Dialog application result in a communications cost which is a small fraction of dial-up phone rates, including all directly and indirectly related costs.

Both Tymshare and Telenet provide their customers detailed data on each user connection. This data, particularly when provided on magnetic tape, has proved extremely valuable in managing the network resources. Besides providing a convenient means of tracking factors such as port utilization, regional and city growth statistics, it also provides information which is useful in comparing tariff options where offered and for evaluating the economics of an in-house network on a city-by-city basis.

A further benefit provided by the value-added network is the end-to-end error-free data delivery (except for the user's local loop, of course), and complete maintenance responsibility. When maintenance is required, it is performed rapidly.

The Telenet network commenced commercial service in mid-August and the Dialog system became operational on it in mid-September.

The Dialog system runs on an IBM 360/65 with an IBM 3704 front-end processor. The 3704 is linked to Telenet by means of a synchronous access line and contains a Telenet-furnished program, the Telenet Modified Emulator Program (TMEP), for controlling the interface.

The Dialog system was the second installation of the 3704/3705 Telenet Emulation program extension.

TMEP is a solution to a major problem the Arpa net faced in providing a totally transparent host-network interface. It allows the host software to continue supporting terminals in precisely the same way as it did before and performs the required software interfacing and line control for network access in the front-end.

This software system did require some debugging at our site, but this proceeded rapidly with Telenet's technical support. In the following two months of operation, the front-end has run without a single problem or crash.

Estimating the average number of packets per connect-hour used by Telenet proved to be both simple and accurate. The average number of user commands per hour was known along with the resulting breakdown as to short (single-packet) and long (multiple-packet) outputs. The highly output-intensive Dialog application results in good packet utilization and thus an economic means of delivering large volumes of characters to our users.

We have, at this writing, conducted in-house testing of Telenet and completed an initial user test in which several users in each Telenet city were requested to make their own evaluations.

Their reactions have been uniformly positive. They helped point out some of the weak areas of the preliminary user instructions we had prepared, and a couple of them ran into the typical start-up problems of not setting the duplex switch correctly or not finding an appropriate terminal identifier.

These problems are typically identified and resolved with just a few minutes discussion and most could have been obviated with more comprehensive user instructions. Generally speaking, once users learn the very simple connect procedure they become fully self-sufficient.

Radwin is on the staff of Lockheed Information Systems in Palo Alto, Calif.

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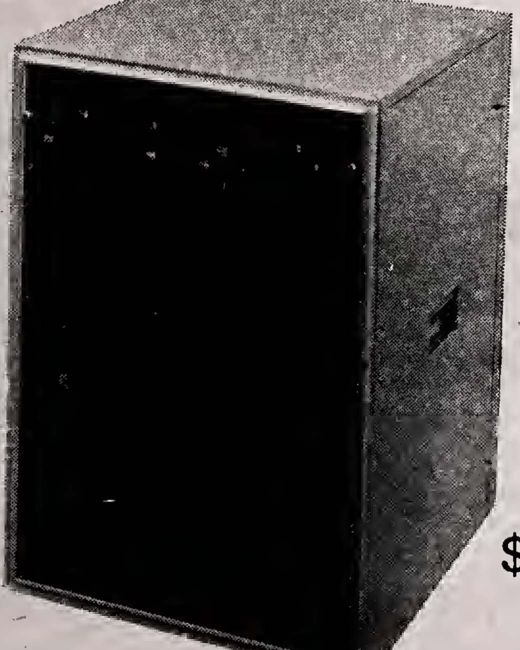

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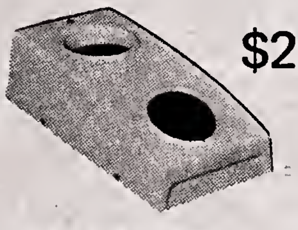

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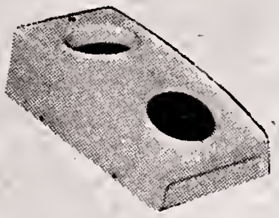

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Doubt Still Present Regarding Bell's Claims for DDS

(Continued from Page S/2)

no one knows. As for Ma Bell, she's not telling. No one at Bell has even publicly admitted the possibility of using anything but DUV for DDS.

The price of DDS service is not the only thing that is unsettled. Claims of better performance are also a long way from being substantiated.

From a communications standpoint, performance can be viewed in three ways: error rate, response time and maintenance. Although Bell is making great claims for DDS in these three areas, it is remarkable how weak the claims appear after examining each in detail.

First, it is important to remember that, to the customer, DDS Service will appear fundamentally the same as analog service. Bell provides the customer with an EIA-compatible terminal interface through which data is accepted and/or delivered. A point not often mentioned by Bell, however, is that analog extension service will often be required to bring the joys of DDS to the user (see Figure 1).

For several reasons, which will be discussed below, Bell would prefer to ignore the fact that voice-band modems will always be present in the DDS network. Instead, Bell gives the impression that nearly everyone will be just a few miles from a DDS hub site.

In fact, nothing could be more misleading. A quick glance at the map of proposed DDS cities shows vast areas of the U.S. will not be served by the digital data highways and will require analog extensions (modems).

At present, only 13 cities are included in the DDS network, a far cry from the originally proposed 96 cities by 1976. To make matters worse, the digital intracity routes in major urban areas are not yet installed.

It appears the switch-over to the digital world will not be as painless or as complete as Ma Bell would have us believe.

In all references to error performance objectives, Bell tacitly assumes all-digital transmission. But what are the effects of analog extensions? Performance of the whole link can obviously be no better than that of the analog segment.

Simply comparing Bell's statistics for all-digital DDS vs. analog services produces interesting results. Bell quotes DDS error performance objectives in error-free seconds (EFS). At data rates of 2.4-, 4.8- and 9.6 kbit/sec the 99.5% EFS figure quoted by Bell translates to bit error rates in the vicinity of or worse than 1 in 10^6. It is interesting to note that many modems can offer performance as good as 1 error in 10^6 bits and that the exact relationship between EFS and bit error rate depends on the amount of clumping of bit errors on the facility.

Bell normally claims bit error rates better than 1 in 10^5 over analog facilities using Bell system modems. Thus, at most, the difference in error rate is less than a factor of 10, between 1 and 10^6 and 1 error in 10^5. In many cases the error rates may be the same or even better on analog facilities.

Of course, the case of DDS with Bell analog extensions has yet to be tested for error performance. Expectations are that this hybrid service would offer error rates consistently worse than all-digital DDS.

Even supposing the difference of a factor of 10 in error rate exists, is this a significant difference? Considering the fact that nearly all data communication uses some type of ARQ protocol for error control, the question really is: Does transmission throughout efficiency go up greatly if bit error rate is lowered from 10^5 to 10^6?

For block lengths up to several thousand bits and for one-way propagation delay up to 100 msec the answer to the question is "No, not really."

For example, operating at 4.8 kbit/sec over a long link with 70 msec delay with 1-kbit blocks, the difference in throughput efficiency at 10^6 and 10^5 is less than 1%.

Plans to Offer Multipoint

Although multipoint service is presently not available, Bell plans to offer DDS multipoint some day. In a multipoint environment, response time is critical to performance.

The response time of a communications link figures heavily in determining the

(Continued on Page S/10)

Intelligent Terminals Fast-Growing Area

(Continued from Page S/3)

erators. This permits all data-entry activities to have access to current information and, when appropriate, to treat disk data as a commonly accessed "electronic tub file."

To overcome these disadvantages of the single intelligent terminal, some vendors have incorpoated the concepts of intelligent terminals in clustered versions. In systems such as these, each display can perform as an independent intelligent terminal with respect to user-programmed data entry. Multitasking software allows data entry to run concurrent with processing and communications.

Where this is well designed, there is a compatibility of programming, communications and operations that makes the intelligent terminal complement the clustered system.

Using such a family, an organization may tailor the elements of its distributed processing network to fit the throughput requirements of each site.

Thus, on the one hand, we have the distinct advantage of a powerful intelligent terminal processing system – extremely useful at a site when limited data entry and remote processing is required.

On the other hand, there are the disadvantages for sites which require greater data-entry capacity of higher cost per display, lack of shared files and duplicated peripheral devices. These requirements are met in clustered versions of intelligent systems.

To tie the two together and allow the user a single-source vendor, a well-designed system must have compatibility of programming, communications and operations between single-terminal systems and clustered systems.

This gives the user the flexibility to configure distributed processing networks with small as well as large sites, it minimizes training difficulties and provides a clear and simple growth path for each remote site.

Seigle is director of marketing support at Sycor, Inc.

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CRT Devices Link Architects With Data at Branch Offices

By Brent D. Barkley

Special to Computerworld

Display terminals are helping Reynolds, Smith & Hills Corp., an architectural engineering firm in Jacksonville, Fla., provide essential technical information and processing capability input from remote engineering branch offices.

The company provides a range of services from branch offices located throughout Florida and the Southeast.

Typical engineering projects are environmental studies where mathematical modeling is done of air and water quality. Flood plane delineation, oceanographic and coastal process data is evaluated, and conventional engineering evaluation and architectural evaluation is researched.

Structural analysis, water network design, sanitary sewer design and, in the architectural areas, project scheduling, Pert and CPM applications are also done.

For this complex task, Reynolds, Smith & Hills looked for many months for a data terminal which would satisfy its needs for being able to provide interactive communications from remote sites to its system.

The computer system is a Univac Series 70 Model 46, having a Virtual Memory Operating System (VMOS) and incorporating multiprogramming capability.

Accessory equipment on the system includes a 1,200 line/min printer, eight disk drives for a total of 200M bytes of storage, three magnetic tape drives and up to 16 remote terminals. In addition, there is off-line equipment consisting of graphics equipment for rapid transfer of data from maps or drawings to the computer.

Features of 40+

The 40+ data display system from International Communications Corp. (ICC) was selected by the firm for its remote terminal requirements because it had all the features required to handle fast, complex input of data, programming and hard-copy output at the remote site.

Rodney D. Ghioto, engineer and environmental systems analyst for Reynolds' Orlando office, played the key role in selecting the 40+ for its application.

He felt the 40+ with a line printer running at 1,200 bit/sec provided the needed capabilities for the remote engineering offices and provided the data link to the CPU in Jacksonville.

The 40+ terminal system is located in the engineering office in Orlando, Fla. Initially, the system was installed at 300 bit/sec full-duplex.

Analysis Made

It was found that 30 char./sec was slow for the firm's needs, and an analysis of the costs was made.

It was determined that, by field upgrading the terminal to 1,200 bit/sec half-duplex dial-up utilizing a foreign exchange line (Wats) at a fixed rate per month, Ghioto could save a significant amount of money, up to half of what the initial costs were, for a regular direct-dial facility from Orlando to Jacksonville.

It was a simple matter to upgrade the 40+ from 300 bit/sec to 1,200 bit/sec through internal switch options, and it was running at 1,200 bit/sec on-line within a day.

Considered Other Terminals

During the evaluation and selection phase, Ghioto had looked at several other terminals such as Hazeltine and Bell's Dataspeed 40. In the evaluation it was found Hazeltine and Dataspeed 40 could not meet all of the performance requirements.

Other terminal vendors had a difficult time meeting the service and delivery requirements which were rather stringent at the time.

The company made the decision to select ICC's 40+ following a performance evaluation period on site.

The 40+ provides a remote input to the Univac system and enables the systems analysts, engineers and programmers to go on-line and provides them with the applications needed.

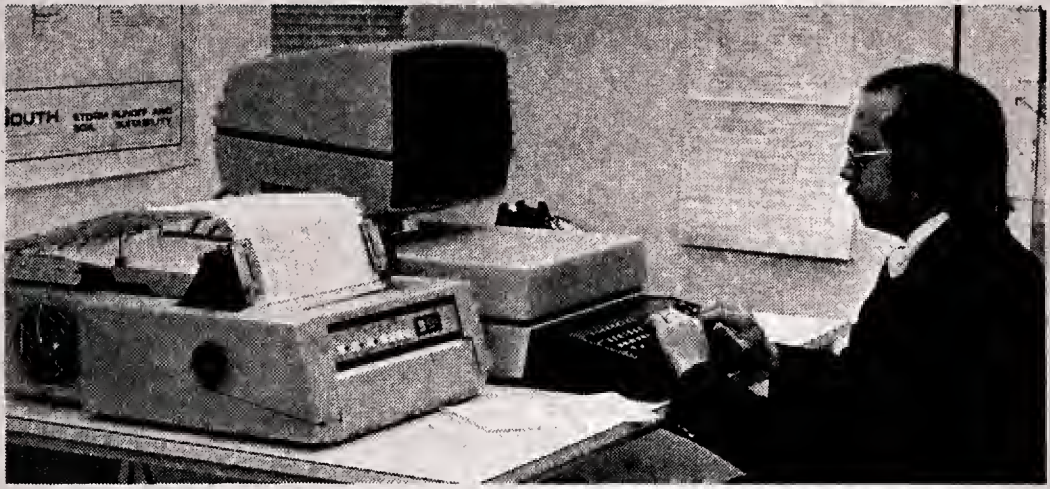
Two Primary Groups

Two primary groups are included in these applications: conventional engineering systems and environmental systems.

There are programs within the Univac applications software to calculate regional water supply and waste water disposable optimization, water network analysis, sanitary sewer design and solid-waste collection.

The environmental systems include programs for hydrologic water quality, thermal dispersion and ground water modeling. In addition, numerous other programs are available and can be executed through the 40+ terminal.

Ghioto feels it essential he have access to a terminal system for on-line data input and he feels "he can't work without access to a terminal because of the R&D nature of his work.


Rodney D. Ghioto is shown at the keyboard of the ICC 40+ terminal.

Typical Problem

A typical problem was one in which Ghioto had to have a complete hydrology model for 250 miles of flood canal with greater than 1,000 subwater basins.

For a while many of the engineers and

(Continued on Page S/18)

MOVE OVER 1403.
THE 2550 IS HERE.

Make room for the Dataproducts 2550 horizontal-font printer.

Until recently, the IBM 1403 train printer has been the industry standard for quality printing at 1100 lines per minute (LPM).

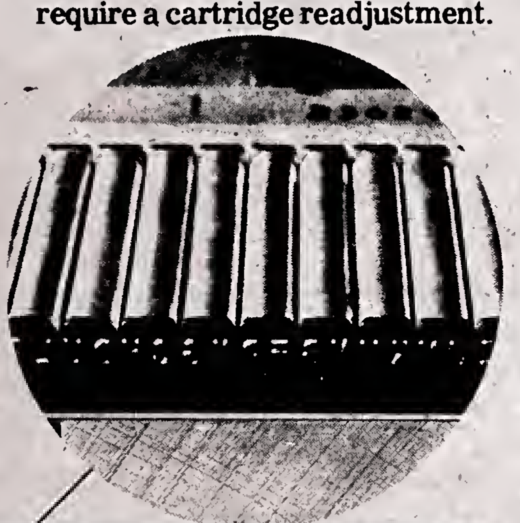
But now the 2550, with the Charaband® print drive, sets a new standard at 1500 LPM.

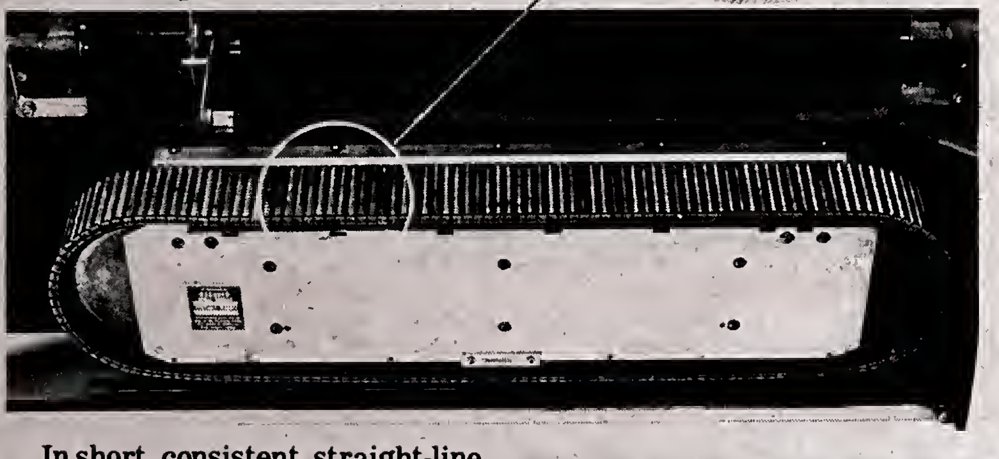
Or, 36% faster than the 1403.

Horizontal Font Printing

The Charaband is a horizontal-font carrier that offers all the advantages of train printers, and eliminates the disadvantages of sliding friction.

The 2550, combining the Charaband with our patented Mark IV hammer, offers a highly reliable friction-free print mechanism.





In short, consistent, straight-line, high quality printing.

Reliability Plus

The Charaband is driven on a roller bearing system to eliminate sliding friction and lubrication systems.

And, unlike train printers, very little wear occurs in the print mechanism.

Reliable operation—equals much less down time.

On-the-job Flexibility

The Charaband carries two complete fonts—one on each side.

The fonts are reversible.

The 2550 also offers replaceable character-type modules that don't require a cartridge readjustment.

A 90° swing-open gate for easy access to Charaband, ribbon and paper.

And simplified controls built into your own "quietized" cabinet.

The 2550 Costs Less

It costs less than the 1403.

Yet, its exclusive Charaband design is a clear-cut improvement in line printer technology.

How do we do it?

Simply by specializing.

Dataproducts is the leading independent printer manufacturer in the world.

And by concentrating in one technology, we are able to make a better printer.

For less than the competition.

Our 2550 Charaband printer is 1500-LPM proof of that claim.

Interface Compatible

The 2550 can be interfaced with almost every major computer system that requires high-speed performance.

So we invite you to call or write for full information and specs.

Remember, Charaband horizontal-font, 1500-LPM speed, less down time and less money.

Little wonder the former industry standard has to move over.

Dataproducts
The Line Printer Company

6219 De Soto Avenue/Woodland Hills, Calif. 91364/Telephone (213) 887-8451/887-8147

Reasonable Doubt Exists as to Bell's Claims for DDS

(Continued from Page S/8)

overall response time of a polled, multipoint network. Link response time is defined as the sum of the round-trip propagation time of a link (including modem or DDS line driver delay) plus the setup time (time between a Request-to-Send signal and a Clear-to-Send signal) of a modem or DDS line driver.

In polled systems where messages are short and often infrequent, the network response time is primarily determined by link response time. As messages become longer and more frequent, the link response time takes on less importance in determining operating characteristics.

The response times for DDS links are very different from those of analog facilities. Because DDS is bit-oriented, DDS link response times are longer at lower data rates and shorter at higher rates.

In contrast, data transmission over analog links produces link responses that are shortest at the lower data rates such as 2,400 bit/sec.

This fact is borne out by statistics supplied by the Bell system (Technical References PUB41022, PUB41005). The results show that, at 2,400 bit/sec, analog facilities provide approximately a 2:1 advantage in response time over DDS. The advantage is true for short-, medium- and long-haul connections.

At 4,800 bit/sec, DDS and analog facilities are roughly comparable for long-haul and medium-haul circuits. For short-haul circuits, DDS 4,800- and 9,600 bit/sec facilities are predicted to have shorter link response time.

Of course, the statistics for DDS multipoint service are still only theoretical. It remains to be seen what the actual performance of the DDS network will be when it finally is put together. The question of analog extensions in a multipoint environment has not been discussed by Bell.

In configurations where multipoint analog service is tied to DDS, the link response times of DDS will necessarily increase moderately at 2.4 kbit/sec, more strongly at 4.8 kbit/sec and disastrously at 9.4 kbit/sec. In fact, in this mode of operation, analog facilities will have response time advantages at all three data rates.

One of the biggest single pitfalls of DDS lies in the area where most prospective users expect it least: system maintenance.

Although Bell touts incredibly high availability goals for DDS, there is no good reason to believe Bell can meet them. Indeed many users of Bell modems and analog facilities have often found the phone company excruciatingly slow in responding to communications problems in the field.

To combat this problem, a whole industry has sprung up that specializes in diagnostic gear for users who want to control, monitor and help to maintain their own data communications networks.

But by far the most distressing aspect of DDS is the user must relinquish his right and ability to monitor and control his own networks. The user will be "blind" to the workings of his links, except to observe message errors at the computer or the terminal. Users will have no way of pinpointing problems or speeding the repair process.

After a problem is found, users will have a tough time establishing a backup connection to handle data traffic while the digital link is being repaired. Dial backup for digital links will be tricky and expensive, because DDS terminal equipment does not produce signals suitable for transmission over the direct distance dial (DDD) network.

The user can, of course, purchase VF modems that do nothing but provide dial backup, but that seems rather impractical. With no recourse to a backup system, the user must simply wait for the phone company to repair the digital link.

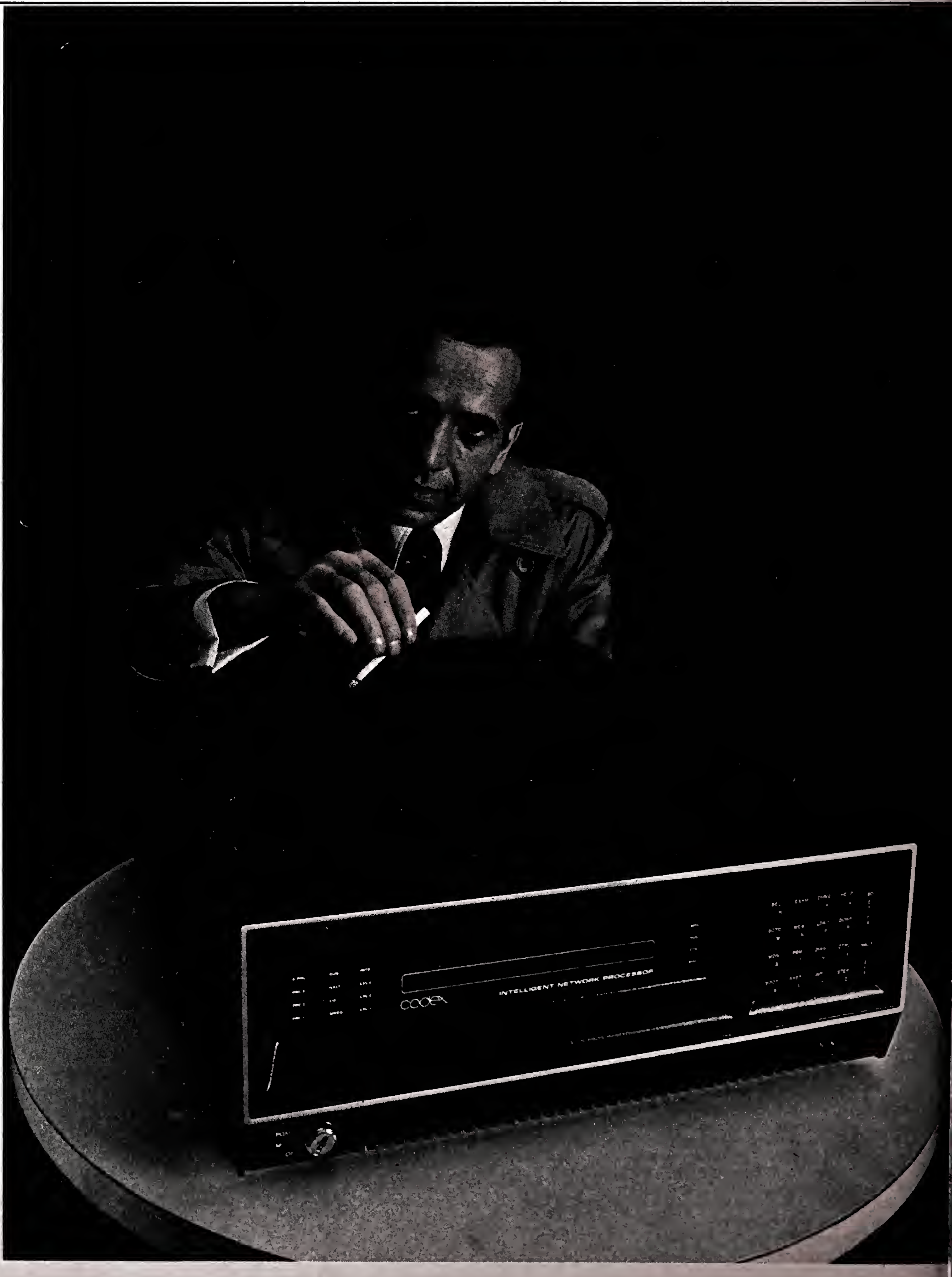
It is interesting to note, however, modems used on private-line facilities are generally capable of operating over DDD circuits as well. With dial backup for analog links, the user can be up and running in seconds after a private line fails.

The little extras many users of analog links take for granted will not be available with DDS.

Independent secondary and reverse channels for sending low-speed data along with high-speed data will not be available. On DDS-type facilities the lowest speed service available is 2,400 bit/sec. Using DDS, it is impossible to send both full-rate (2.4-, 4.8-, 9.6 kbit/sec) data streams and low-speed (110-, 150-, 300 bit/sec) secondary channel data together at no extra charge. With ordinary private voice-grade lines, there is no additional line charge incurred when secondary channels are frequency-division multiplexed with high-speed data.

Alternate voice communication on the same lines used for data will also not be available with DDS. Any voice coordination with remote site personnel must be made via separately routed telephone facilities at extra cost.

Lyon is manager of research for Intertel in Burlington, Mass.



In Past Five Years

Communications Increasingly Used to Link Systems

By David J. Farber
Special to Computerworld

Over the past five years, there has been a rapid evolution of the use of communications facilities to interconnect data processing systems.

Initially the computers involved were limited to large-scale scientific and business systems.

As the usefulness of these interconnected processors became more and more a part of the way organizations used computers, it became clear the large-scale computers were not adequate and they were too expensive to perform certain tasks that were necessary in such computer networks.

A major task that must be performed in any data transmission-oriented application is to control the communications lines and the transmission of information between the main processing units that constitute the distributed system.

The control of data and recovery from errors is a major task and is one that places a heavy real-time demand on the main processors (hosts). Over the past several years, this function has been migrating from the main processors to front-end miniprocessor-based units.

Two examples of this are found in contemporary systems. In the Arpa net the front-end processors – the Interface Message Processors (IMP) – are completely responsible for the delivery and routing of the data as well as the correctness of the transmission.

Another example is found in many corporate data networks where the use of mini processors as telecommunications controllers allow companies to use long-distance expensive communication lines in an optimal fashion.

In one particular application in the construction industry, allowing the front-end minis to compress character data and to do forward error control paid for the cost of the minis in the first six months of operation of the data line.

Terminal Controllers

As the number of host machines that are available for cooperative or distributed processing increases, the problem of how to allow users to access the various services that exist on such networks becomes major.

Here again mini and micro processors have found a place as terminal controllers. In the case of the Arpa net there are two types of such terminal controllers. The first of these is a combined front-end communications controller and a terminal controller.

Its function is to allow terminal and remote batch configurations to economically access the network and thus the attached service machines. These combined-function minis are called Terminal IMPs (TIPs).

The second type of terminal front-end is the miniprocessor which acts in two roles in the network. One is as a small multiuser computer system which allows users on terminals to create data and text files and to examine the results of runs that have been made on the network service machines.

In addition they can act as front-end terminal machines to allow terminal access to the network's large-scale resources.

A number of such systems exist on the Arpa net. They are called ELFs, ANTs or UNIXs and are currently all on Digital Equipment Corp. PDP/11 minis. They remove these time-consuming activities from the large computational servers of the network and thus allow both faster interactions for the users as well as much cheaper access to the network.

Other Uses

Existing networks of computers have concentrated on the interconnection of large systems that are geographically separated by large distances. There are other uses for the networking capabilities that involve the interconnection of computers that vary in size, but are locally distributed within buildings or shopping centers, etc.

The purpose of such interconnections are to allow for the distribution of local processing for reliability reasons as well as for economic reasons.

Examples are found for this type of networking in the process control area, in the command and control domain as well as in the commercial banking sector.

In addition, such local networks tend to be used to distribute the information that may be coming in from national and international networks to terminals and/or computers that exist on the local sites. There are a number of examples of such

(Continued on Page S/18)

The Private Eye.
It solves the mystery of data communications networks.

The new Codex 6000 Series Intelligent Network Processor.

The Codex 6000 combines the most attractive features of time division multiplexers and computer-based concentrators in a unique microprocessor-based system architecture optimized for data communications.

The 6000 slips into a network without a clue it's there. It's completely transparent to network protocol, terminal mix, system configuration or existing control facilities – yet requires no customized programming.

Investigate how the Codex 6000 cuts line costs by combining statistical bandwidth allocation and data compression – outperforming traditional TDM's by factors as high as four to one, with less node-to-node delay. You can trust the results – data is assured error-free by a full-duplex internal ARQ protocol.

The 6000 checks out all the facts. From a central-site communications and control console, the 6000 surveys your network, collecting statistical data on terminal error rates, trunk performance, node performance, data compression efficiency, line utilization, etc. Then computes it and reports it. Assign it pre-set performance thresholds, and it notifies you when they're exceeded. Use it to identify bottlenecks, to arrest inefficient use of resources, to initiate diagnostics, and to reconfigure system characteristics.

The Private Eye from Codex, sweetheart. Provides you with a great case for better network planning, management and growth. Another innovative product for the communications networks of tomorrow, from Codex, today's technology leader.

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We'll get you through

member of
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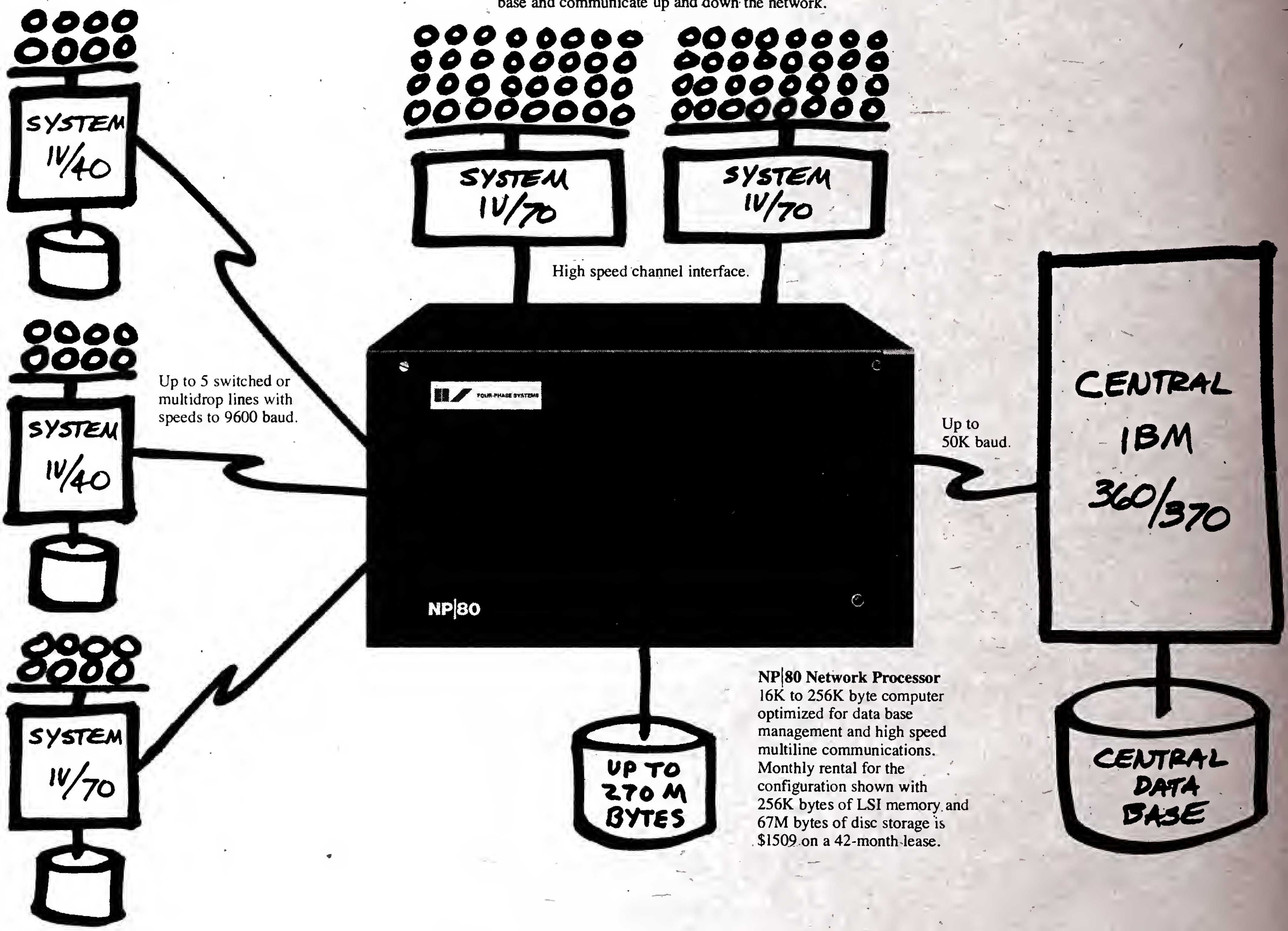
Codex Corporation, 15 Riverdale Avenue, Newton, Massachusetts 02195, (617) 969-0600, Telex: 92-2443
Codex Europe S.A., Bte 7/Av. de Tervuren 412, B-1150 Brussels, Belgium, Tel: 762.23.51/762.24.21, Telex: 26542

NP|80: The new Network Processor that distributes your data the way your company is organized.



Remote locations with up to 32 displays per system.

Up to 64 local displays can access the NP|80 data base and communicate up and down the network.

High speed channel interface.

Up to 5 switched or multidrop lines with speeds to 9600 baud.

Up to 50K baud.

NP|80 Network Processor
16K to 256K byte computer optimized for data base management and high speed multiline communications. Monthly rental for the configuration shown with 256K bytes of LSI memory and 67M bytes of disc storage is $1509 on a 42-month lease.

Remote Locations

Regional Center

Central Office

Hierarchical networks for hierarchical organizations.

Makes sense doesn't it. Ideally, information should flow up and down a network as it does in an organization . . . with geographically distributed files at branch, district, and regional locations in keeping with departmental scope and span of control.

But until now, a simple solution for these intermediate sites has not been readily available.

What's needed is a new kind of processor that can complement today's remote systems by filling the gap between the lowest level in the network and the central office. What's needed is a unique computer for large regional and district sites . . . optimized for distributed data base management and wideband multiline communications.

What's needed is the NP|80—the new Network Processor that distributes your data the way your company is organized.

NP|80—the missing link.

Four-Phase Systems' NP|80 is a new computer system that complements and extends the capabilities of our popular System IV/40 and System IV/70, field proven with over 70 million operator hours.

Designed for use at intermediate network locations, the NP|80 lets you distribute computing power and data files naturally throughout your organization while preserving compatibility with both current line disciplines and IBM SDLC protocol.

Up to 64 local displays can access an NP|80 data base of up to 270 million bytes through direct channel connection of two System IV/70's.

These same displays can also access your central data base at speeds up to 50K baud through the NP|80's wideband communications facilities.

While performing data base management and communications services for the local System IV/70's, the NP|80 can concurrently provide master multipoint control for an extensive network of remote Four-Phase systems with speeds up to 9600 baud.

Now each level of an organization can store frequently used data in local system files for interactive access. At the same time, operators can retrieve information stored at higher and lower levels throughout the organization.

As a result, system response patterns can be matched to local requirements through flexible application of total network resources.

Multilevel network access.

Multilevel distributed processing adds a new dimension to remote computing.

Displays at remote locations can access local, regional, and central files with automatic routing based on data availability. Typically, most transactions will be processed against local files while exception transmissions are passed to the next highest level.

Similarly at regional sites, transaction processing can be supported by both local and central files while down line communication is pipelined through the NP|80 with negligible CPU loading.

Central control with local autonomy.

Now line managers can assume responsibility for the data processing they require. Needed reports and documents are easily generated at remote locations using COBOL, RPG, Sort, Assembler, DOS, and an extensive selection of utilities. And programming can be done either locally or at headquarters.

For data base synchronization, branch and regional files can be updated from the central site. Detailed information in these files can also be accessed by headquarters when required.

Complete freedom exists to tailor networks exactly to your needs. Regional NP|80's can communicate with district NP|80's which in turn can communicate with branch System IV/40's and System IV/70's.

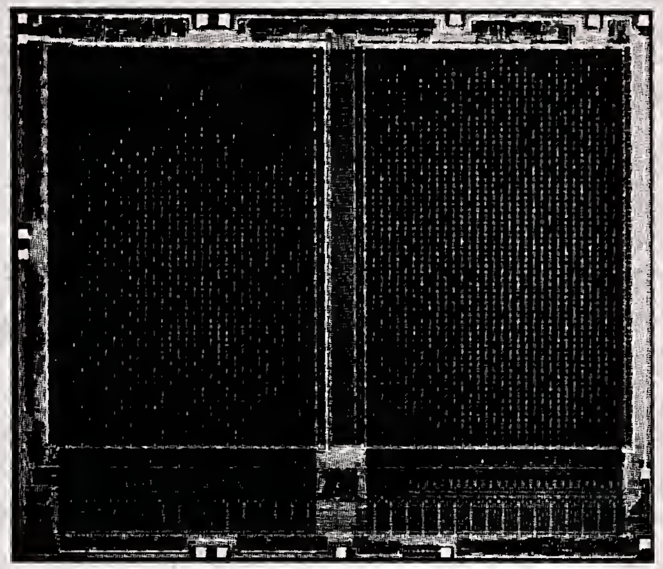
Through such multilevel processing, the NP|80 offers large network users enhanced system performance, increased functional capability, expanded display support, reduced mainframe loading, hierarchical fallback, and greater flexibility in meeting changing or expanding requirements.

Distributed data management.

NP|80 network control and data management services are provided by a resident multiprogramming executive. While transparent to system users, the NP|80 can concurrently support shared file access and high speed communications for separate application programs on two System IV/70's.

The NP|80 performs indexing, searching, and deblocking operations for the attached System IV/70's while handling communications concentration for the lower level systems. Blocks of up to 128 sectors may be read or written by the NP|80 with a disc transfer rate of 1.2M bytes/second.

The parts we needed didn't exist, so we had to make them ourselves.



Magnified view of Four-Phase's new 16K-bit n-channel silicon gate RAM.

In 1970 we introduced the industry's first computer with LSI semiconductor memory and an LSI central processing unit.

In 1972 we shipped the industry's first systems with 2K LSI RAM's.

Now with the NP|80, we've created another milestone—*the first computer to be introduced with 16K LSI RAM's.*

We design and manufacture not only the displays and computers employed in our systems, but also the LSI components used in them. Not because making semiconductors is our business. But because producing the most advanced distributed processing systems is.

256K bytes of network processing power.

This hand contains all the 16K-bit RAM chips needed for the NP|80's 256K byte memory with error correction.

The heart of the NP|80 is a powerful 16-bit computer with 500 ns cycle time and up to 256K bytes of LSI memory.

The system includes multiple DMA channels, software and hardware error recovery facilities, firmware diagnostics, a memory relocation and protection system, and communications control for up to six high speed lines.

To learn more about the NP|80 and our comprehensive selection of distributed processing software, send for our new brochure.

Four-Phase Systems

Four-Phase Systems, Inc., National Marketing Headquarters
19333 Vallco Parkway, Cupertino, CA 95014

Please send me the new NP 80 brochure.

Mainframe ________ No. and type of terminals ________

Name ________ Title ________

Company ________

Address ________

Telephone ________

City ________ State ________ Zip ________

Optional Data Communications Carriers Proliferating

(Continued from Page S/6)

establish in-house networking expertise to allow them to cope with and constructively evaluate the myriad of service possibilities in their own shops.

International network optimization is also receiving significant attention these days. The amount of traffic to overseas locations is on the rise in most every user organization that has any business activities outside the continental U.S. Leased-line charges between countries tend to be noticeably higher than for comparable distances in the U.S.

This means the payoffs for a well-designed, cost-effective network are that much bigger on the international scene.

Part of the difficulty faced by most users is a relative scarcity of people and organizations which understand the alternatives and choices available for voice, record and data transmission services to locations outside the U.S.

Increasing Net Productivity

However, careful awareness and study of the alternatives may open up new possibilities for increasing network productivity and cost-effectiveness.

If multipoint data communication lines are not fully loaded, it might be possible to put more terminals per line and reduce the number of lines. This would reduce line costs and perhaps port charges and modem charges at the central site.

AT&T Telpak extension pricing is scheduled for elimination during the month of November. In the past it has been possible for users to price all mileage for lines outside of Telpak according to the old voice-grade line tariff, if at least part of the circuit was routed through Telpak.

Many users took advantage of this tariff provision to pass channels through very short Telpak sections and then have very long mileage runs to Lo Density locations priced using Telpak extension tariffs.

The impact of this loophole elimination means users of Telpak extension tariffs will be forced to pay more for such channels. It appears as though AT&T will force users to price these extensions according to the Hi Lo tariff as well.

Since such Telpak extension circuits will now be priced according to Hi/Lo, it may be possible for users to run such channels directly back to their concentrators or computer centers and not pass through Telpak at all.

Savings possibilities exist from evaluating the benefits of such rerouting of data circuits currently assigned to Telpak.

Location in the same state as the DP center can be connected to the central site using either intrastate or interstate tariffs. The user must evaluate both possibilities and use the one which is collectively lowest cost.

Intrastate pricing will govern situations where these locations in the same state are connected using circuits which have no drops outside the state. If one or more drops outside the state shares a circuit with these locations within the state, then the entire tariff will be priced according to Hi/Lo.

Cost-saving possibilities exist in situations where there are a substantial number of locations in the same state with the DP center.

With the eminent availability of 56 kbit/sec DDS at substantially reduced prices from a current Series 8000 wideband offering, it may become possible for users to justify multiplexing and concentration of synchronous lines at substantial distances from their central points.

In the past it has generally been true that Series 8000 wideband data offerings did not offer much of an economy over individual channels priced according to Hi/Lo. This will change with the institution of 56 kbit/sec DDS pricing at noticeably lower rates than previously available with Series 8000.

Users should investigate the possibility of scheduling the use of their lines for different applications at different times of the day. Many on-line networks do not need to use lines except during normal business hours.

In many cases then it will be possible for a customer to use a certain amount of leased-line capacity for the on-line application during normal business hours and flip the line usage over to the other less critical applications in the evening hours. This will eliminate the need for multiple leased lines to accommodate the two or more different kinds of applications.

Users operating multipoint networks of more than a few dozen terminals should continually evaluate whether or not the assignments or terminals to circuits produces a collectively minimal cost network.

Many leased-line networks grow with a series of individual terminal additions to an existing network. Sometimes users fail to collectively design the entire network for minimum cost in such situations. A simple regrouping of terminals to circuits can produce almost 10% to 15% cost reduction at no degradation in performance.

Some users ignore the possibilities of realizing cost savings as a result of auditing their telephoning and common carrier bills regularly. Common carrier invoices can contain appreciable billing errors.

When one user called an error to the attention of the common carrier, he was given a retroactive credit that amounted to a savings of more than $3,000 in a particular situation. Users should take the time to make certain they are being invoiced only for specific carrier facilities they are using. And they should also be concerned with making sure that the billing invoices for such services are correct.

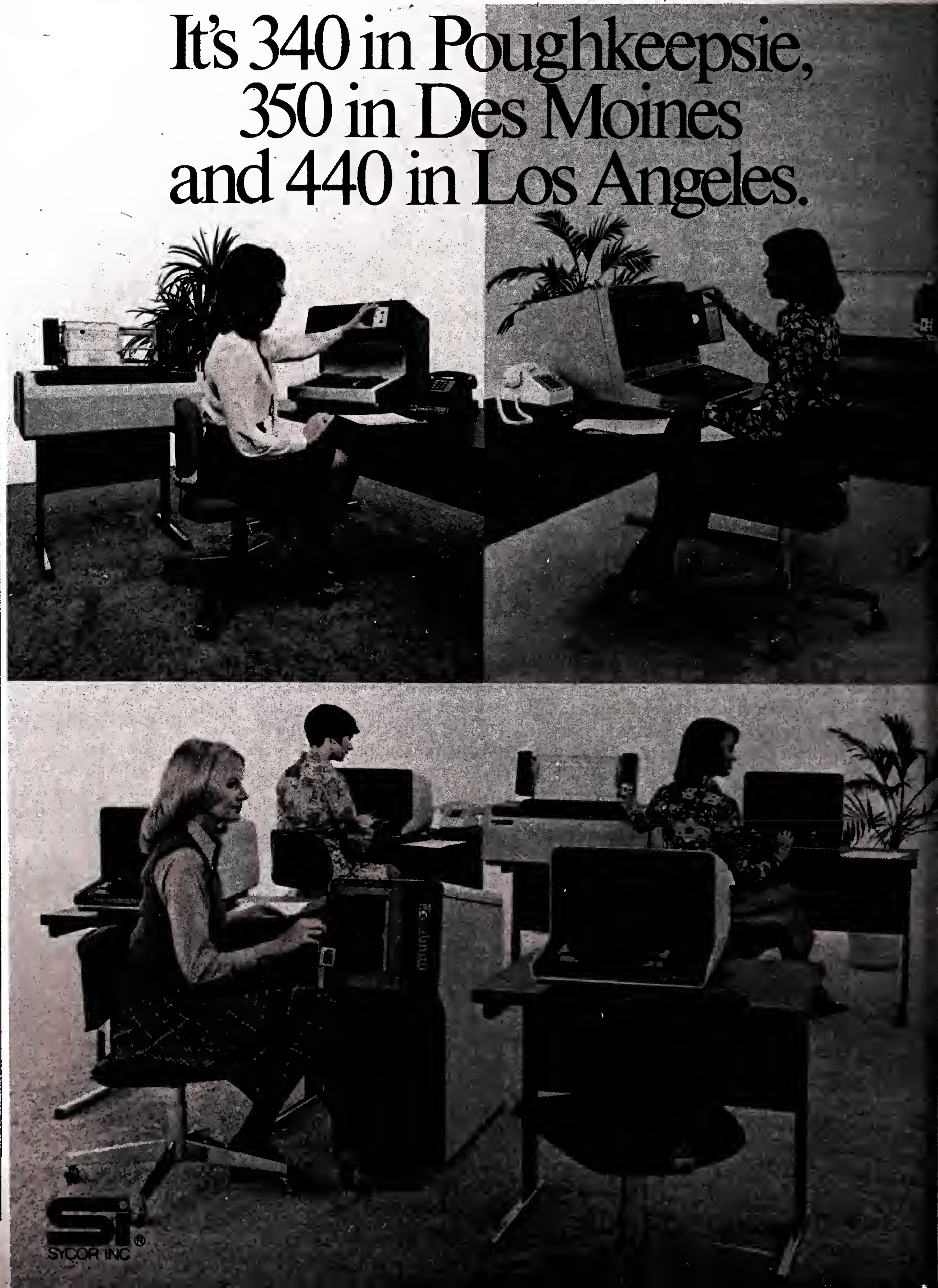
There is a popular belief among the data transmission community that satellite channels with their long propagation delays may not prove cost-effective for Binary Synchronous Communiations (BSC) applications of batch data transfer or polling.

While it is true that the effects of a propagation delay does directly affect performance in BSC channels, it is by no means certain that this effect will always be unacceptable.

In many cases the production of very substantial cost savings may more than justify slight degradations of performance. This may hold true either in batch data transfer application or in polling environments.

Users should periodically evaluate their collective requirements for bandwidth in each of their remote locations in their network. It may turn out that the use of the previously mentioned dual-stream

(Continued on Page S/23)



In Comparing Capabilities

Study of Eight Nets Should Prove Useful to Users

(Continued from Page S/3)

specified format."

Essentially, each addressed packet occupies a transmission channel for the duration of the transmission of the packet only. The channel is then available for use by packets being transferred between other users. Thus, channels between packet switches are shared among many users on a demand basis, and it becomes possible for a customer having a single link to his packet switch to engage in the exchange of data packets with a number of other users at the same time.

To a user, a packet-switching service can be regarded basically as the acceptance and delivery of well-formatted packets. For the computer attached to the system (the host computer) a simple protocol is also required for the immediate link with the network to deal with local flow and error control and with those control signals which are outside the stream of data packets.

A packet-switched system with these simple functions has been called a "primitive packet-switch" or "datagram." Such systems represent one end of the spectrum of packet-switched systems.

In the simple system described above, a packet is launched into the network without knowing the state of the receiving device and a stream of packets might be sent which cannot be delivered.

Although packets are unlikely to be delivered garbled, they may possibly be lost or duplicated in transit. The packet sequence can also be changed, on occasions, because of the variable delay due to routing and to retransmission following an error.

Protocols which deal effectively with all these deficiencies can be left up to the host computers or incorporated into the packet-switching communications network.

In the latter case, the network can be used to provide the logical equivalent of a circuit between computer and computer or computer and terminal. This has been called a "virtual circuit." A protocol is required to set up the virtual circuit between what is effectively a port on the computer and another port or terminal.

In addition, a procedure is required for using the virtual circuit once it has been established.

Several important characteristics of a packet-switching network influence the requirements imposed on the user considering connecting his computer or terminal to the network. The characteristics are defined here and used subsequently in the survey.

Any membership qualification for joining the network must be satisfied. Existing and planned networks can be categorized into two classes: private and public.

Private networks are restricted to a closed community such as an organization or a research community with common interests. Public networks are operated by a public carrier as a service.

Private networks which are developed for research and experimentation purposes may not be cost-effective in providing services, but public networks will need to offer cost-effective services to survive.

The type of packet service provided may be of the simple datagram type or a virtual circuit, as discussed above. The simpler service is likely to impose greater demands on the user to perform functions otherwise performed in the communications network.

For terminal-to-computer traffic, the choice of the most cost-effective communications system depends on a number of variables such as location of host and terminals and traffic characteristics.

Packet-switching is undoubtedly a viable alternative for certain mixes of the variables. For computer-to-computer traffic, the principal alternative to packet-switching is direct connection (dedicated circuits), which is only possible for two or three computers.

Packet-switching provides a number of capabilities not usually otherwise available. The automatic error control results in improved transmission error performance.

The redundancy of alternative routing means greater availability. Data rate and character set conversions permit data exchange between otherwise incompatible terminals and computers. Perhaps most important is resource sharing, i.e., the ability to access over the network different and unique facilities.

A summary of the survey appears in

(Continued on Page S/20)

Providing for Future Unique to Standards

(Continued from Page S/3)

Each has user terminals connected to links in the network. The object is to provide data communication, not only among terminals of one network, but among terminals in different networks.

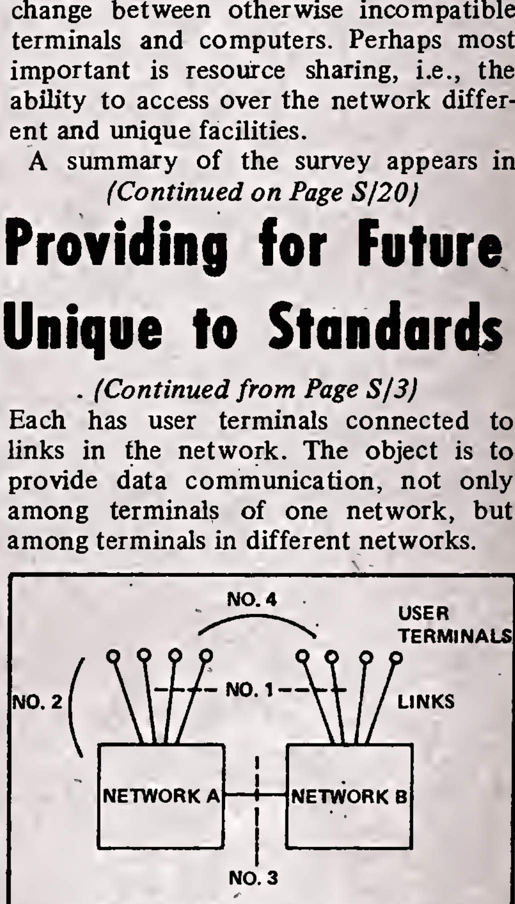


Figure 2. Types of Compatibility Standards

A number of compatibility standards should be considered for the data communication networks shown in Figure 2:

- User-to-link. This standard covers the mechanical and electrical characteristics at the physical interface between terminal and communication line. It includes the definitions of the functions of the signals exchanged over the interface circuits.
- User-to-network. This standard covers the compatibility of procedures or protocols. It includes methods for encoding addresses, for requesting and terminating

(Continued on Page S/16)

Now there's a family of distributed data entry and processing systems that you can tailor to the requirements of your remote sites.

If you've considered the advantages of distributed data entry and processing, you've probably discovered a sad truth:

A system that's fine for Poughkeepsie might be a washout in DesMoines.

Different sites have different needs. From remote data entry, to communications, to remote inquiry and response, to on-site report and forms generation.

And to overwhelm a small branch with high-powered equipment is just as bad as under-equipping a large one.

To match each of your branches with exactly the right equipment, in both hardware and software, there's only one terminal manufacturer to turn to. Us.

We're as flexible as you are.

Using our Sycor Models 340, 350 and 440, and their wide range of peripheral equipment, you can pinpoint capability to site requirements and price.

Our Model 350, for instance, might be just the ticket for your two-man operation in Des Moines. While a larger branch in Los Angeles might require the concurrent background processing capabilities of the Sycor 440.

And, while each of the three terminal systems has its own unique capabilities, they all work together in a remote processing network.

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The Model 340.

For smaller office situations that call for data entry, you'll find our Model 340 the low-cost intelligent answer.

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If you need the advantages of random accessibility, look into the Model 350. The 500,000 "fill-in-the-blanks" characters on its exclusive dual flexible disks let you store customer, product/price and salesman files right at the source.

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Data Communications Standards Provide Future Plan

(Continued from Page S/15)

connection through the network and for recovering from unexpected failure conditions. While it is primarily a software or programming standard, it may have a direct impact on the terminal hardware requirements.

- Network-to-network. This requires agreement between the suppliers of communication service regarding the link connecting two networks and the associated control procedures. It is normally not of direct concern to a user, as long as he is provided the internetwork capability he expects.
- User-to-user. This includes the end-to-end compatibility requirements for coding, message formats, terminal identification and security. Network standards are often not required here, since agreement between two user terminals may provide the compatibility needed.

There are two different types of communication procedures used in these networks. The primary difference, from the user viewpoint, is the steps which occur at the user-network interface. One uses circuit switching, like a voice network. The method involves these steps:

- Request a line and receive a go ahead.
- Key in the identification address of a called terminal (dial).
- Receive response from called terminal.
- Conduct two-way conversation.
- Terminate call.

The second type of network provides message switching, like a network used to send telegrams. The method involves these steps:

- Compose message.
- Add one or more addresses at beginning.
- Request a line and send one-way message into network, which delivers it.
- At later time receive acknowledgment of receipt of message if that function has been requested.

Work on the development of a new type of data network control, called packet switching, has shown that greatly improved efficiency may be obtained through message switching of relatively small packets of data with decentralized control.

Two kinds of user-network interface standards have been suggested:

- Packet interface. Datagrams (like telegrams) are sent into the packet-switching network, across an interface designed to handle those datagrams or packets.
- Virtual call interface. The user in this case perceives that a circuit-switched call is being completed, like a telephone call, even though the network itself may function in a packet-switching mode.

There are two primary organizations conducting international standards development programs today in data communications.

The Consultative Committee for International Telegraphy and Telephony (CCITT) is chartered by the United Nations to provide for integrated and compatible worldwide communications.

Voting membership consists of the common carriers and telecommunication administrations of each participating country.

Every three or four years a CCITT Plenary Assembly is held to give official approval to new and revised recommendations. Many administrations adopt these CCITT recommendations as national regulations and require conformance..

Two CCITT study groups on data have been formed to develop recommendations for approval at the next Plenary Assembly, scheduled next year. One is Special Study Group A. It covers the use of voice facilities for data transmission. The other is Study Group VII, which develops recommendations for public data networks.

The International Organization for Standardization [ISO] membership is composed of the national standards organizations of each of the participating countries.

It has a number of technical committees which prepare international standards in a wide range of technical areas. Technical Committee 97 covers computers and information processing, and its Subcommittee 6 develops standards for data communications.

The CCITT study groups and ISO technical committees with similar interests and objectives work closely in the development of standards. In a number of important areas, they have established whether one group will have primary authority.

In the matter of interface standards, no decision is made without concurrence from both. The meetings of both are attended regularly by observers representing the other organization.

The official U.S. delegations to CCITT study group meetings are formed under the guidance of the Department of State. Preparatory groups meet as required to study issues and to formulate the U.S. positions regarding questions and recommendations in the work program of the study groups.

These U.S. preparatory groups are generally composed of qualified experts from communication common carriers, government agencies, communication users and equipment manufacturers.

ISO participation is organized differently. The American National Standards Institute (Ansi)–assigns responsibility for each different subject to a technical advisory group, which develops positions for submission to the appropriate ISO technical committee or subcommittee and determines the makeup of delegations to ISO meetings.

The data communications responsibility is assigned to American National Standards Subcommittee X3S3, which also prepares similar domestic standards for use in the U.S.

In addition, Electronic Industries Association Committee TR-30, which works closely with X3S3, provides important inputs regarding interfaces and related EIA standards.

Issues Studied

CCITT Special Group A studies modem types and interfaces. These are used both on leased lines and on public telephone facilities. Standard modems have been identified and several functional modem interface descriptions have been published by this group.

Recommended transmission rates in bits per second have been established. An attempt is now being made to extend the modem capacity to 4,800 bit/sec on the public-switched telephone network and

(Continued on Page S/19)

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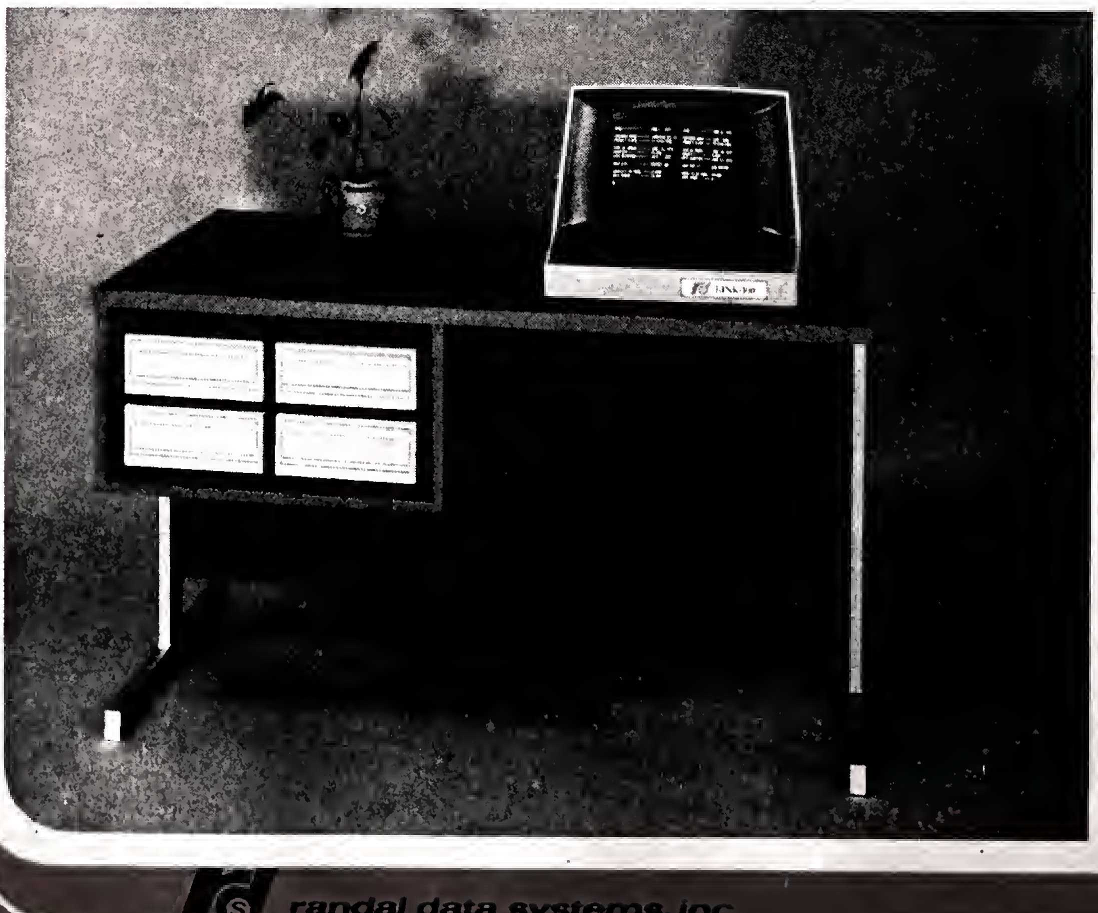

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Much Like Railroads

Type of Net 'Traffic' Must Fit Supplier's 'Tracks'

By Ivor G. Kaye

Special to Computerworld

Anyone who has been even remotely associated with data communications over the past 10 years does not have to be reminded of the progress made in this field.

There was a time when a user had a choice between just two possibilities – he either used the telephone network (a service designed primarily for voice, not data traffic) or he leased a private line from the telephone company between Point "A" and Point "B."

Now we have arrived at the point where there are so many different services available from so many different suppliers that most computer users who utilize data communications are somewhat confused.

The large number of "private" digital networks which have sprung up across North America are, in a way, much like a railroad: they can carry only certain types of traffic (the traffic has to fit the tracks). There are, in most cases, severe restrictions on code and speed which must be obeyed by the mainframe or terminals when they are plugged into one of these networks.

Also, just as a railroad line may end at a terminal, requiring freight to be forwarded to its destination by road, so it is with most digital networks. The data normally is transmitted between major centers digitally, but has to complete its journey by other means such as analog loops and limited-distance modems which might be compared, in this analogy, to roads and tracks.

What has happened to data communications in North America over the past decade has been – using as charitable a phrase as can readily be found – "disorderly development."

Unless a sensible plan is devised and followed, data communications, as with any other form of transportation, becomes chaotic. Just as railroads and highways carry their traffic quickly and economically, so should communications routes.

The analogy between railroads and highways on the one hand and, on the other hand, communications links such as digital systems and analog "backbone" links is a useful one in that it implies certain questions.

An obvious and important one is "Why not go the whole way by road?" That is, why not use analog facilities and modems in all cases?

The answer is simple: digital systems are more efficient, offer a better performance and can be designed with the versatility to handle anticipated future needs of data communications.

What About the Future?

What, then, will the networks of the future have to offer? How will they affect data processing?

In a recent study on future trends in computer terminals carried out by the Communications Research Centre of Canada's Federal government, some interesting facts may be found. One is that "the cost of logic circuiting will decrease at a faster rate than basic communications."

This will lead to a situation where there is an incentive to carry out more processing at a local level or to carry out sufficient preprocessing to reduce the amount of redundant information to be transmitted. Clearly, this will tend to reduce communications costs.

However, over the next five to 10 years, the cost of basic communications will not be reduced to any large extent. But various changes in tariffs will give the data communications user some price breaks for certain types of digital transmissions.

Basic communications costs will be reduced significantly only when extremely wide-band carriers (such as waveguide and optical fibers) are implemented, and that is still quite a way down the road.

Looking at some of these pointers and bearing in mind the cost of replacing or adding existing plant to the common carriers' networks, at least three important things will happen:

- Digital networks will take over as the prime data communications carrier.
- The digital networks which will emerge will utilize as much existing plant as possible and more use will be made of placing multiple terminals on one loop.
- The digital networks will have built-in intelligence. They will not be code- or speed-sensitive. Also, if the regulatory agencies ever get around to addressing the problem, these networks will have a certain amount of data processing capability and will operate in the mode most suitable for the particular terminals or computers they are servicing, that is, either store-and-forward or real-time.

Digital networks will provide the basis of new developments and applications for computers. An application such as store-and-forward facsimile transmission is a typical example.

The intelligence embedded in the network can take the analog information (generated by a low-cost, low-speed facsimile terminal) and convert this information locally to a digital format. The computer in this location also removes redundant material.

The information can be stored in a conventional manner on disk or magnetic tape and it can be transmitted to a remote location where the computer reconstructs the digital data into its original format before addressing the destination terminals and transmitting the information.

In this example, the intelligence of the computer is used to achieve economical transmission or facsimile information which, for example, if it were sent from coast to coast in its original form, would take at least three minutes per page and cost accordingly.

Using the computer, the printed information can be preprocessed locally and transmitted over the same distance in 25 seconds or so.

The facsimile example is used because, it seems, for at least 25 years, knowledgeable people in communications have been saying that "facsimile is *the* thing for the future."

Serve Narrow Segment

Unfortunately, up to this point in time, the manufacturers have been developing terminal equipment with little or no thought devoted to the network itself. They have ended up with various terminals which, in themselves, can serve only a very narrow segment of users.

Had the industry taken more advantage of the computer and developed a network capable of making terminal usage more economical and more efficient, we would have seen much more use made of facsimile equipment today.

Computer terminals which are virtually 100% digital and which, in many cases, have some intelligence start with a big advantage, but the network of the future must be able to complement these machines and allow the small business operator to have one terminal which may be used for message traffic, local processing and for access to specialized computer installations.

This implies a "master" network must come into existence and will have access to virtually all the "private" networks now in existence. The new network will have to act as a "clearinghouse" and route traffic to the appropriate private network for onward delivery.

There will be no more questions about whether a Burroughs machine in New York can interchange information with a Honeywell machine in Los Angeles. The network will take care of it.

Pause for a moment and consider the number of different types of terminals available today. Every one of them is trying to achieve something that can only be accomplished with real efficiency by concentrating the intelligence within the network.

Kaye is marketing manager of ESE Ltd. in Toronto.

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Systems Linked by Communications Evolved Rapidly

(Continued from Page S/11)

networks operational at the current time. One of these is the Xerox Corp. network that exists within the Palo Alto [Calif.] Research Center (Parc) of Xerox.

This network connects together a large number of terminals and small computers and is used for both internal communications to access the larger machines at Parc as well as to investigate office automation issues.

Another network of the local nature is the Ring network at the University of California at Irvine. This network is used to provide the integrated communications capability to support a distributed computer system composed of mini and micro processors.

In both cases the architecture of the communication system was dictated in large part by the locality of the communications involved and the fact the host machines were mini and micro processors and terminals.

In the future, the role of the new-technology small machines will impact the network-oriented systems even more than they have to date. We see in the research world and in the advanced development stages within the commercial sector a number of emerging technologies which will impact these future directions.

The investigations into intelligent terminals and the appearance of the small processors which look like terminals (the IBM 5100 for example) suggest the computing game will be further fragmented into processing within the terminal to do both those tasks that are efficiently done locally like editing, scrolling, etc. and those tasks which allow the increasingly more complicated distributed computer system that is connected by digital networks to appear to be simple and easy to use by the user sitting at his terminal.

The programming of the terminal to allow it to handle the complex systems that are now accessible will allow the user to ignore the complexity of the environment and to concentrate on the job he has to accomplish. The research in the intelligent terminal area has just this aim.

Network-Oriented Systems

In the network-oriented systems of the near future, the data bases that constitute the operational data will be physically distributed to promote reliability, accessibility and to allow the data and its control to better conform to the structure of the organizations that own it.

The replacement of centralized data (and, as I said before, computing power) has also been made practical by the changing economics brought about by the emerging small-processor technology. The application of these ideas has been undertaken by numerous agencies within the government as well as by the two largest banks in the world.

The evolutionary path of the large-integration solid-state tech nology guarantees that, in the future, processing capability can be placed wherever it is optimal from the standpoint of the user or the economics of the situation.

In that world it is clear that many effective places for such power are in the areas of the system which are either operating the communication system or are taking advantage of its existence.

Farber is associate professor of information and computer science at the University of California at Irvine.

Architects Linked With Branches

(Continued from Page S/9)

analysts worked in their mathematical modeling and analysis directly on the computer with card inputs.

When these complex analytical services were found to be needed in the remote sites, it was necessary to have a terminal on-line with the system to provide the service capability to the remote offices.

Programming is done on the 40+ in Fortran IV, Level G language under a resident editor program. Programs are compiled and stored in the system and executed when needed. A program often used is the Reynolds, Smith & Hills Hydrologic Simulator.

The program provides for realtime simulation of the rainfall runoff process and stream flow modeling adapted to specific areas of the country. The system provides simultaneous flow routing and water surface profile calculation.

Among other uses of the system, the ICC 40+ terminal is used for accounting purposes, internal billing and management information such as project status.

Reynolds, Smith & Hills' plans for the future, depending on the expansion, will be to eventually link all the field offices and the home office in Jacksonville with remote terminals giving the engineers, analysts and programmers total on-line capability.

Barkley is marketing manager of terminal products at International Communications Corp.

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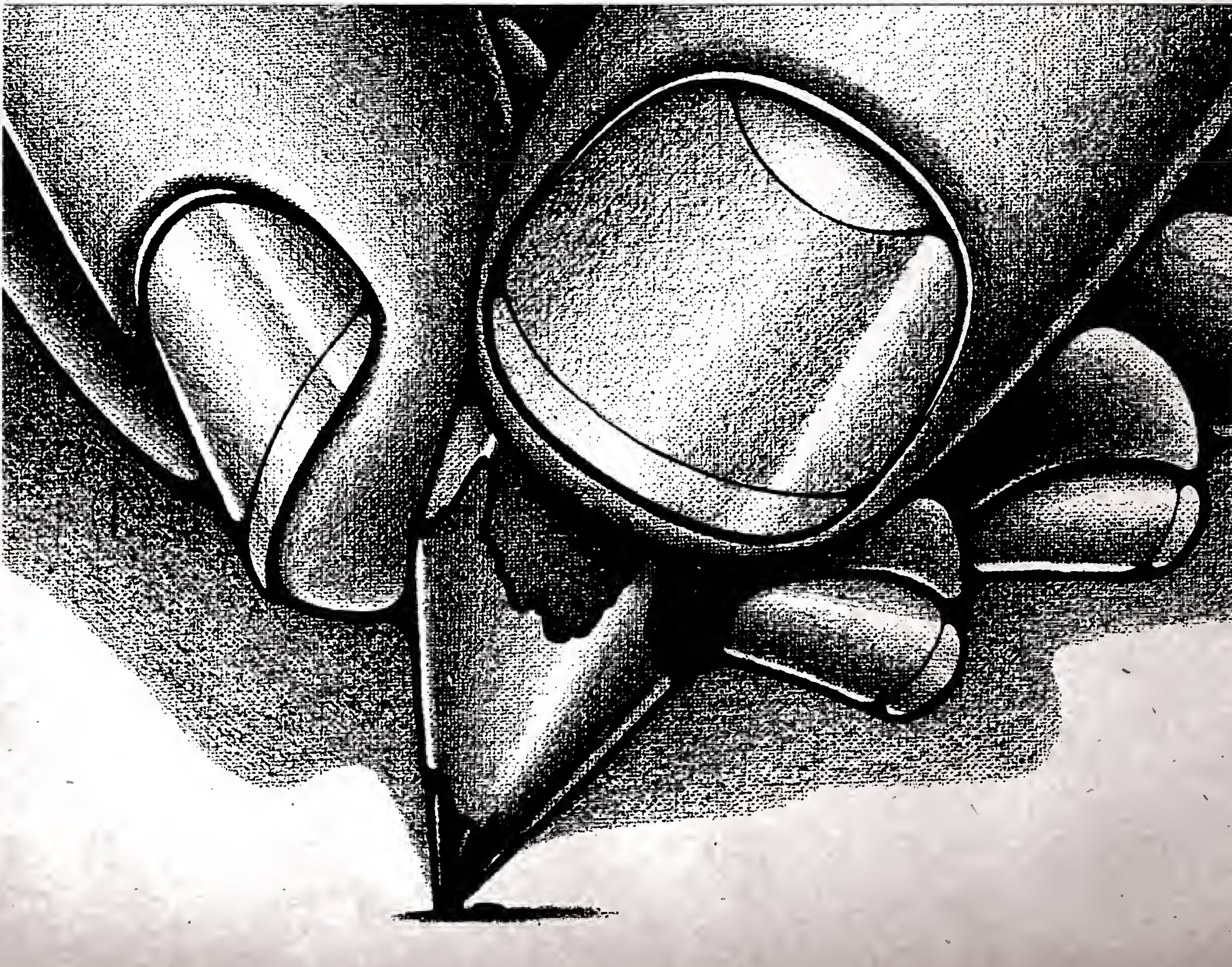

To Ensure Flexibility

Future Planning Unique to Communications Standards

(Continued from Page S/16)

to 9,600 bit/sec on leased lines.

Criteria for testing and evaluating modem designs on actual and simulated telephone facilities are being discussed, with the aim of establishing new high-speed standard modems.

Faults in a communication network can often be located and corrected if loopback connections can be made in response to requests from user terminals. A recommendation for standard loop-testing procedures is being developed.

CCITT Study Group VII

A CCITT Study Group VII recommendation for a public data network interface has been prepared. It is now being studied and improved, to provide for better address signaling, error control and call progress signals. It relates primarily to compatibility between user and network, shown as No. 2 in Figure 2.

An important issue is the matter of character synchronization or timing. Some member delegations believe the common carrier or PT&T administration should always control character timing at the interface.

Others maintain that the originator of a transmission signal should be free to determine character timing. The problem is to assure proper character alignment at the serial bit stream interface.

A good compromise solution is still being sought.

New recommendations have been published covering balanced and unbalanced interfaces using electrical signals compatible with integrated circuits.

A plan is being developed to incorporate these into new complete functional interface descriptions. It will cover the interface identified as No. 1 in Figure 2.

A special working party of CCITT is investigating packet-switching to determine whether international data networks might include or connect to packet-switching systems. It has recommended study of the packet interface and the virtual call interface as possible areas for standardization.

The CCITT Study Group is working on a solution to network-to-network compatibility at the interface shown as No. 3 in Figure 2. It is relying mainly on common carriers and PT&T administrations for the assurance of compatibility between national public data networks.

ISO TC97 Subcommittee 6

A data communication control procedures program is concerned about individual private networks and about the need to interconnect private networks in a compatible way.

In the future, public data networks may use these or similar standards for working between user and network, shown as No. 2 in Figure 2. Current work is on bit-oriented protocols for single-link control.

A standard message structure is nearing final approval and the elements of procedure have been published by the subcommittee for review.

Several programs on public data networks provide for close cooperation and communication between ISO and CCITT Study Group VII. These include work on interfaces, user facilities and fault isolation for public data networks.

The ISO Subcommittee prepares contributions on these subjects which it forwards to CCITT. Thus is serves as one of the important sources of material from users and equipment manufacturers.

An independent study of packet switching is now under way in ISO.

Several activities in Subcommittee 6 cover Data on Voice Networks between ISO and CCITT Special Study Group A. Projects under way cover modem interfaces and fault isolation.

In some cases, ISO standards have been published covering mechanical interface requirements such as connectors and pin assignments for interchange circuits.

The international bodies listed meet about once per year, with working groups covering detailed studies and document preparation between meetings. The CCITT study groups met in Geneva in May and will convene there again just before the plenary session next year.

The last ISO Data Communication standards meeting was held in Tokyo in October 1974. The working groups met in April and a subcommittee meeting was scheduled in Washington in October.

Wheeler is a standards expert on the staff at Xerox Corp. in Rochester, N.Y.

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To Compare Capabilities

Study of Networks Proves Useful to Potential Users

(Continued from Page S/15)

Figure 1. The figure shows the major user-oriented characteristics of each network as far as can be determined.

Arpa Net

The Defense Advanced Research Projects Agency computer network (Arpa net) is the only existing packet-switching network of its size. Participation in Arpa net is limited to Arpa contractors in support of their work for Arpa and military organizations for reserach and development purposes.

The network comprises packet switches known as Interface Message Processors (IMP) and a great variety of computers or hosts. Each IMP is connected to two or possibly three or four other IMPs to form a distributed network and supports one or more hosts.

An augmented IMP, the Terminal Interface Processor (TIP), can additionally support terminals directly.

The network was begun in 1969 and entered an operational phase in 1971. Currently the network includes between 45 and 50 IMPs or TIPs, about equally divided, and over 50 hosts. In addition to nodes in the continental U.S. there are also a node in Hawaii and two in Europe.

The IMP communications subnetwork provides for the delivery of messages of up to about 8,000 bits from one host to another host. The messages are partitioned into packets of about 1,000 bits for transmission through the network and reassembled in the correct order at the destination IMP.

Hosts near to an IMP are connected by an asynchronous bit-serial interface requiring special hardware at the host side. Messages are transmitted between host and IMP in full-duplex.

Hosts at greater distances can be connected to an IMP by a communications line in which case special error-detecting hardware and software is required at the host side.

In this case, packets are transmitted between host and IMP. The TIP can support a variety of terminal devices, transmitting characters asynchronously at speeds up to 19.2 kbit/sec.

Host-to-Host Hookup

Communication between hosts is conducted according to a host-to-host protocol, which is implemented as a Network Control Program (NCP) in each host. The NCPs control the establishment of logical connections between executing programs; exercise flow control over the connections; and construct and interpret headers at the beginning of each message.

Additional protocols have been defined and programs implemented using the NCP to provide network user capabilities. One of these, the Telecommunications Network (Telnet), enables a terminal at one host or a TIP to establish a logical connection to a host elsewhere on the network and appear as a local terminal at that host.

A file transfer capability enables the movement of files from one host to another host. A message service enables a terminal user to send a message to users at other hosts on the network; messages are stored in the recipient's mailbox file.

The above three capabilities are implemented on practically all Arpa net hosts and used extensively. Other less widely implemented functions include remote job service, whereby jobs can be submitted from one host for execution on another, and graphics, in which a graphics terminal at one host can interact with a graphics application program on another host.

Claims as to the cost-effectiveness of the network have been made, although some of the assumptions used to derive the figures have been questioned. Users have not yet been charged for the traffic they generate on the communications subnetwork, but this is possible in the future.

The communications subnetwork is used particularly inefficiently by the numerous PDP-10 Tenex hosts on the network, which expect terminal intput a character at a time and perform echoing at the host.

The number of packets on the network is also influenced by NCP implementation features such as the flow control system.

Cigale/Cyclades Net

Cyclades is a computer network linking 16 heterogeneous computers in universities and research centers in France with a 7-node packet-switching network. Cyclades is intended to be both an operational tool for government use and a prototype for network experimentation in vari-

(Continued on Page S/21)

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"They did, did they? And just which of our esteemed competitors lays claim to knowledge as vast as our own?

"Well, NCR, Computer Automation, Microdata and Modcomp all use the 580. To name just a few, Sir.

"NCR, hmmmm. Tell me more about this machine.

"Yes Sir! First of all the production standards are impeccable. Seven days burn in at elevated temperatures plus AQL and CQL programs which mean a triple quality check. Quite remarkable when you're producing 1000 units a month.

"Please continue Mr.....

"Bascomb, Sir. Well, standard features include a numeric pad, XY addressing and full cursor controls. Not to mention the sharpest, most readable screen in the industry!

"I see. And just how much is this 580 going to cost me Mr. Bascomb?

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"Yes, yes, yes. Tell me Bascomb, how's your croquet game?"

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Study of Nets' Capabilities Proves Useful to Users

(Continued from Page S/20)

ous areas, including distributed data bases.

Cigale is the name of the packet-switching communications network within Cyclades. Cigale is a simple packet switch, analogous to the datagram.

In particular, there is no end-to-end flow control, error control or sequencing. Those functions are included in the host-to-host protocol.

In Cigale, the host address space is independent from the network topology. Hosts may be connected to several nodes (i.e., dual homing), and several host addresses may be reached over the same line. The latter allows several logical hosts such as distinct host protocols within the same host, several virtual hosts (as in IBM-CP67) or several hosts reached through a front-end computer to be connected on the same line.

Hosts are assumed to be located at some distance away from a Cigale node, requiring connection via leased lines. Transparent binary synchronous communications are used between a host and Cigale.

Consequently, no modifications to host operating systems are necessary, and host-to-host protocols may be implemented as user programs. The ISO standard 16-bit cyclical checksum is employed.

Cigale has no terminal-handling facility for attaching terminals directly. However, a terminal concentrator or minihost has been developed to provide access to the network to users not attached to a host. The terminal concentrator uses the Mitra-15 minicomputer which is also used for the packet switches in Cigale.

Spain's CTNE

The Compania Telefonica Nacional de Espana (CTNE), as the public carrier in Spain, has opened a public packet-switching service with exchanges in Madrid and Barcelona. About 500 terminals are connected to the network at present, the major user being the banking community.

Two distinct services are provided by the network: real-time and message-switching services. The real-time service is directed to closed groups of users, in which the traffic transmitted by/toward a terminal is directed toward/from a determinate host computer, without possibility of direct traffic between the terminals.

This service has a fixed address, which means the messages generated by one terminal will always go to the same host computer.

The message-switching service also serves closed groups of users. It enables an exchange of messages between any two stations (terminals or computers) or a closed group.

In contrast to the real-time service, each terminal can communicate with any other in the same closed group. The network adjusts the message to the condition required by the destination stations, providing code change, speed change and packet arrangement change if necessary.

Terminals are connected to the packet switches by concentrators and multiplexers. In the real-time service, the messages generated by a terminal always have a fixed address; therefore the packets do not have headers between terminal and concentrator. Once this packet reaches the concentrator, a 56-bit header is added and remains until the packet reaches the host computer.

DDX-1

A system integrating circuit switching and packet-switching has been developed by Nippon Telegraph and Telephone (NTT) in Japan. An experimental switching system DDX-1 (Dendenkosha Data Exchange) has been designed and implemented; DDX-1 uses time division multiplexing to dynamically share the wide-band line capacity between circuit switching and packet switching.

One of the features of DDX-1 is the signaling sequence that occurs when a call is placed which allows the caller to select either a circuit-switched or packet-switched call.

If both calling and called terminal are of the same speed and do not require store-and-forward service, both terminals are served by circuit switching. If they have different speeds or require the store-and-forward service, they are serviced by packet-switching.

European Informatics Network

The European Informatics Network (EIN) project originated within Cooperation Europeenne dans la Domaine de la Recherche Scientifique et Technique (Cost) and was formerly known as Cost Project 11. Countries associated with the project are France, Italy, Norway, Portugal, Sweden, Switzerland, the United Kingdom and Yugoslavia, together with Euratom. The project is developing a private packet-switching network with nodes at London, Paris, Zurich, Milan and Ispra (Euratom).

Although the agreement to establish the project was signed in November 1971, it did not come into force until ratified by two-thirds of the participants, which occurred in February 1973.

Since then, most of the effort

(Continued on Page S/23)

	Arpa Net	Cigale/ Cyclades	CTNE	DDX-1	EIN	EPSS	NPL	RCP
Country	U.S.	France	Spain	Japan	Europe	UK	UK	France
Membership	Private	Private	Public	Public	Private	Public	Private	Public
Type of Packet Service	Virtual Circuit	Datagram	Virtual Circuit	Virtual Circuit	Datagram	Virtual Circuit	Datagram	Virtual Circuit
Host Interface Type	Non-standard	Binary Sync.	Serial Sync.	HDLC	HDLC	Non-standard	British Standard	Serial Sync.
Maximum Speed	200 kbit/sec	48 kbit/sec	N/A	48 kbit/sec	130 kbit/sec	48 kbit/sec	N/A	4.8 kbit/sec
User Input	Multi packet	Packet	Packet	Packet	Packet	Packet	Packet	Packet
Terminal Interface	Yes	No	Yes	Yes	No	Yes	Yes	Yes
User Input	Character	—	Packet	Character	—	Character	Character	Character
OS Modification	Yes	No	N/A	N/A	No	N/A	Yes	N/A
User Capabilities:								
Terminal-to-Computer	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes
Computer-to-Computer	Yes	Yes	Yes	Yes	N/A	Yes	Yes	N/A
Economics Considered	Yes	No	Yes	Yes	No	No	No	No

N/A = Information Not Available

Figure 1. Summary of Network Characteristics

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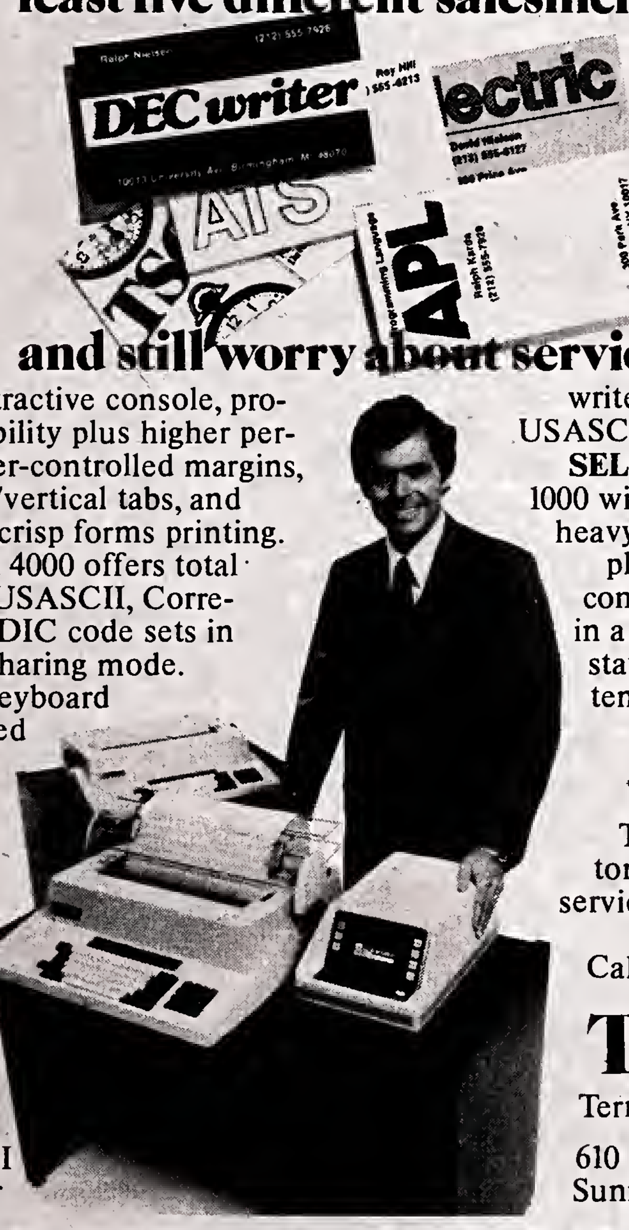

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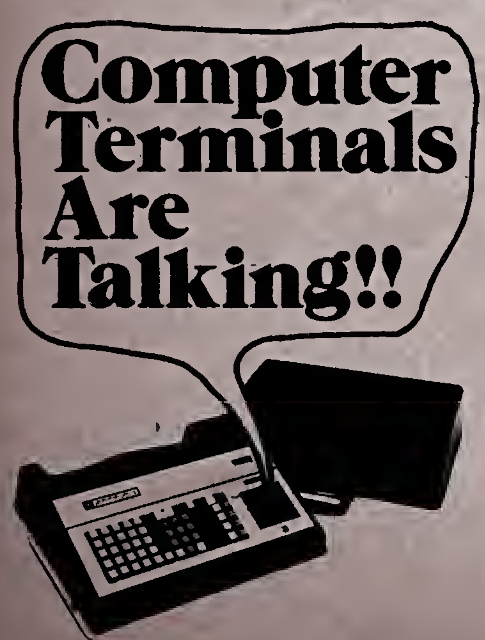
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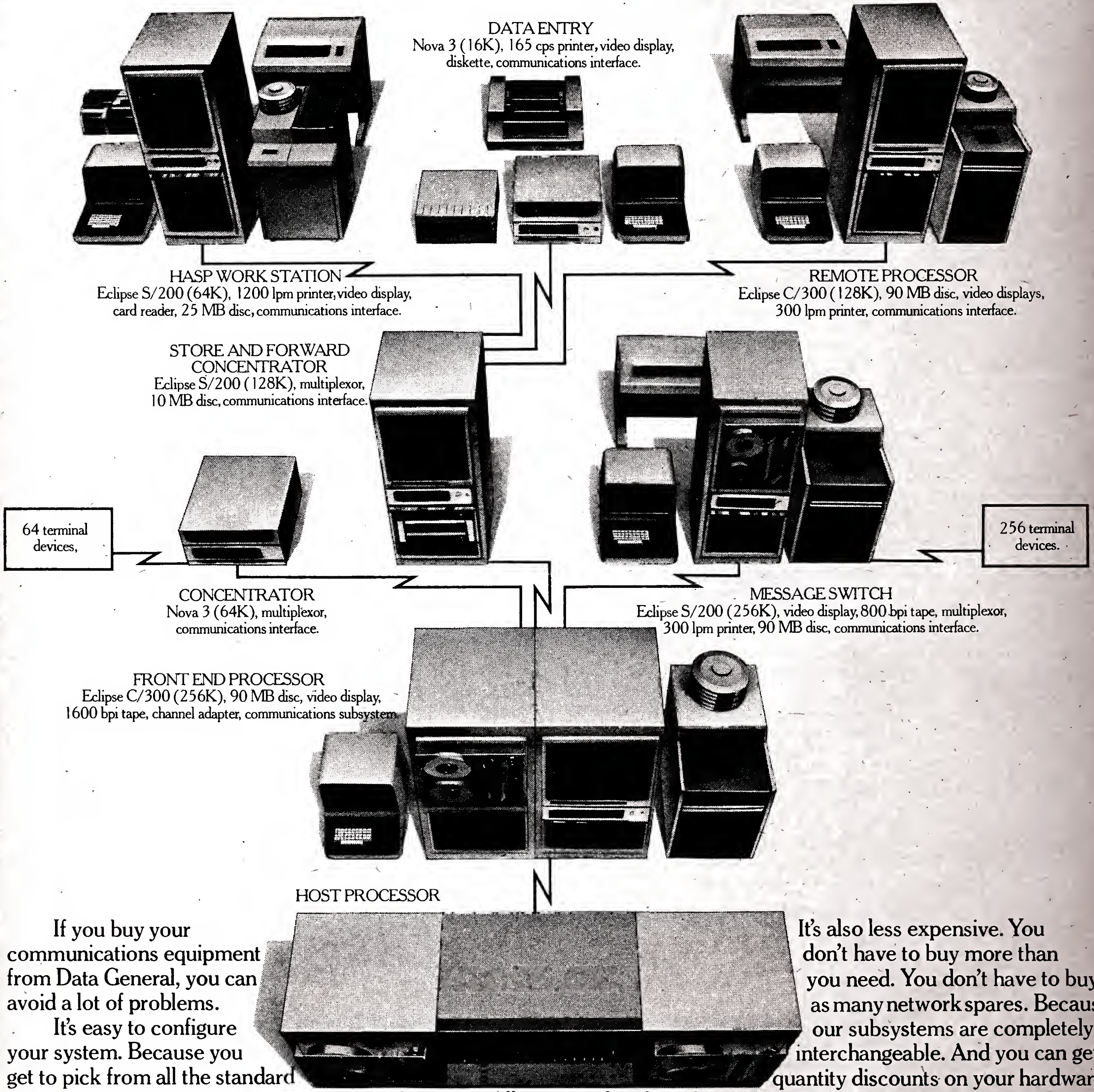
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Eclipse S/200 (64K), 1200 lpm printer, video display, card reader, 25 MB disc, communications interface.
REMOTE PROCESSOR
Eclipse C/300 (128K), 90 MB disc, video displays, 300 lpm printer, communications interface.
STORE AND FORWARD CONCENTRATOR
Eclipse S/200 (128K), multiplexor, 10 MB disc, communications interface.
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256 terminal devices.
CONCENTRATOR
Nova 3 (64K), multiplexor, communications interface.
MESSAGE SWITCH
Eclipse S/200 (256K), video display, 800 bpi tape, multiplexor, 300 lpm printer, 90 MB disc, communications interface.
FRONT END PROCESSOR
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Study of Eight Networks' Capabilities Proves Useful

(Continued from Page S/21)

has been in preparing a specification for the packet-switching communications subnetwork and in selecting a contractor.

The group preparing the specification for the communications subnetwork was faced with the decision about where the boundary between the user and the subnetwork should occur.

The choice of boundary position determines which functions must be performed by the subnetwork and which are the responsibility of the user.

There is some variance among existing networks in this area. Eventually, it was decided to define a basic subset of facilities which would be mandatory and another subset of facilities which were optional in use but had to be considered in the initial design. The connection between host and packet switch is to be full-duplex with error detection.

The EIN subnetowrk is of the datagram type, with no end-to-end control. Protocols at the host-to-host level are presently being defined.

As an international research project, the EIN project is not addressing the economics of packet-switching. However, the project is contributing to the development of standards, the interconnection of packet-switching networks and the knowledge of packet-switching in the participating countries.

Britain's EPSS

The British Post Office (BPO) is currently implementing the Experimental Packet-Switched Service (EPSS) as an experimental public packet-switched network which will provide data to both customers and the administration on the practicality and viability of packet-switching for future data communications.

The BPO prepared the specification and contracted with Ferranti Ltd. in mid-1973 to implement the packet switch within two years.

The experimental network will comprise three nodes or PSEs, one each in London, Manchester and Glasgow. In fact, the PSE at London will comprise three independent modules or Packet-Switching Units (PSU) to improve availability; the PSEs at Manchester and Glasgow each comprise two PSUs.

The nodes will be linked by 48 kbit/sec lines, initially analogue but later digital.

Each node will be provided with a number of ports to allow the connection to the system of two separate categories of customer terminals.

One category is packet terminals, capable of constructing, transmitting and receiving standard format packets. The other category is character terminals, capable of operating only in character mode. For such terminals, the local packet-switching exchange is required to assemble characters into packets and break down packets into characters.

Lines to the packet terminals will vary from 2.4 kbit/sec to 48 kbit/sec synchronous; lines for character terminals vary from 50 bit/sec to 300 bit/sec asynchronous.

The BPO specification sets particularly stringent requirements for reliability of the packet switches which are being met by multiprocessor packet switches.

The packet protocol is based on the concept of a call. A call is set up by the calling terminal generating a "call-originating" packet and the called terminal responding with a "first-response" packet. Further packets in the call are called "subsequent" packets.

Packets between a PSE and a customer packet terminal comprise a header and data. When a packet arrives at a PSE from a customer packet terminal, it is converted into a form suitable for transmission on the EPSS network by attaching a "main network addition" to the packet immediately after the data.

The main network addition is removed by the destination PSE before the packet is delivered to the terminal. The length and content of the packet header and the main network addition are different for the various types of packets.

The PSE-to-customer packet terminal line transmission protocol allows packets to be transmitted simultaneously in both directions, but second packets cannot be transmitted until the first is acknowledged.

High throughput is achieved by generating and transmitting the acknowledgment two byte times after receiving the checksum. The acknowledgment is transmitted at the fixed time in the transmitted data stream, even in the middle of a packet.

NPL Data Communication Network

Research in packet-switching networks at the British National Physical Laboratory (NPL) predates Arpa net, having commenced in 1966. NPL has implemented on the laboratory site a data communications network which comprises one node of a packet-switching network to which a large number of computers and terminals are attached.

Host computers (known as user machines) communicate with the packet switch by sending and receiving packets over a full-duplex link. The packet switch offers a datagram type of service but the host-to-host protocol creates a virtual circuit.

Each host is connected to the packet switch via a special interface or Network Termination Unit (NTU) which is physically adjacent to the host. The NTU is connected to the host by a pair of standard interfaces (BS421) and the NTU can exchange special status signals with the packet switch to control the flow of packets.

Terminal devices can access the network directly by means of the terminal processor (TP) which appears logically to the packet switch like a user machine.

In fact, the terminal processor coexists with the packet switch like a user machine.

The packet switch and terminal processor are implemented in a 32K Honeywell 516. It has a duplex processor for reliability, providing a cold standby. Throughput is about 1 million packets per day with a peak performance of 5 million bit/sec.

Approximately 12 computers and 85 terminals are connected. One of the host computers, also a Honeywell 516, controls a central file store comprising 60M bytes of disk storage.

The Reseau a Commutation par Pacquets (RCP) is being developed by the French Postal, Telephone and Telegraph (PTT) authority. RCP is an experimental prototype network which is expected to result in the definition and implementation of a public packet-switched data transmission service. The initial configuration of RCP consists of three packet switches, in Paris, Rennes and Lyon, and three time-division multiplexers, each connecting a distant city to a packet switch.

Customer computers have access to the network through 4,800 bit/sec transmission lines over which they can have several interleaved conversations with other computers and/or terminals.

'Virtual Circuits'

Data transmission is based on the establishment of full-duplex "virtual circuits" between pairs of customers. The virtual circuit is characterized by flow control at both ends and a low undetected error rate.

Over such a virtual circuit, data is transmitted as a sequence of 8-bit bytes with interspersed end-of-message markers. The number of bytes between two end-of-messages is arbitrary. Messages may be split into packets or grouped consecutively within the network, but the sequence order of data bytes and the position of end-of-message markers is guaranteed at the destination.

The packet switches are PDP-11 Models 20, 21 and 40, each with 24K words of memory. Fixed routing is used and a fixed buffer allocation is assigned for each virtual circuit of 32- or 256 byte/node depending on class of service.

A call request is required to set up a virtual circuit. A call request includes the address of the called customer, the address of the calling customer, a collect call flag which if set indicates the called customer is to be charged for the call and a class of service indicator.

Two classes of service are defined: low-peak throughput calls with less than 120 byte/sec and high-traffic calls with peak throughput above the limit.

Wood is a staff member with Mitre Corp. in McLean, Va.

Carrier Proliferation Offers Users Options

(Continued from Page S/14)

transmission techniques, including modem-sharing devices, port sharing devices, split-stream modems and inverse multiplexers will enable the same applications mixture to be accommodated at lower cost than the current configuration.

Such possibilities do not always exist. But in many situations, the relatively low cost of these building blocks makes it easy for users to find substantial savings resulting from their usage.

In networks of at most a few dozen terminals the networking layouts which should be used with such techniques are usually obvious. In more complicated networks with a larger number of terminals, the use of computerized design approaches and the evaluation of numerous different combinations of line routines, transmission speeds may be the most sensible approach.

Doll is president of DMW Telecommunications Corp. in Ann Arbor, Mich.

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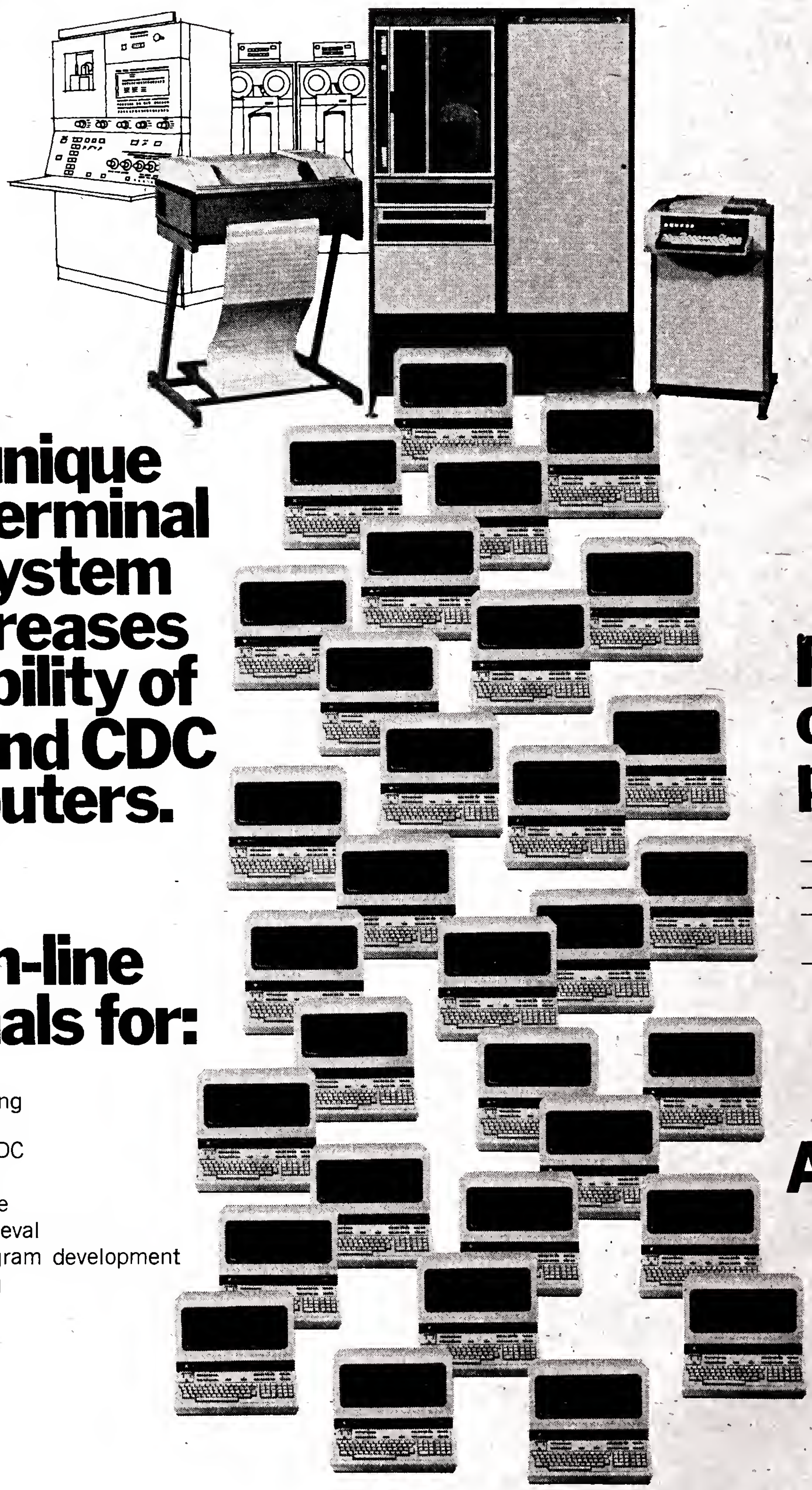

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Mini Bits

PDP-11s Get Add-On Memory

FORT LAUDERDALE, Fla. – Core memory capacity of Digital Equipment Corp. PDP-11 minicomputer systems may be increased to as much as 124K words with an add-on memory system recently announced here by Standard Memories, Inc.

Designated the Ecom H-11 system, the product is available in two rack-mountable configurations. The smaller unit, with a capacity up to 64K in 16K increments, fits into a standard 5-1/2-in. rack. The larger version can accommodate up to 256K in 16K increments and fits into a 12-1/2-in. rack. Full memory cycle time is 750 nsec, minimum.

H-11 systems are immediately available at single-unit prices of $3,225 for 16K, $7,865 for 65K and $15,715 for 124K.

Okidata Offers HP Interface

MOORESTOWN, N.J. – Users of the Hewlett-Packard (HP) 2640A CRT terminal can now tie their display unit to the Okidata CP 110 (110 char./sec) printer by the use of a plug-compatible interface package from Okidata Corp.

The interface, including six feet of cable and an HP connector, provides direct access to the 60 line/min capabilities of the Okidata printer, enabling it to operate like the 9866A line printer, according to Okidata

The printer/cable interface in quantities from one to nine is $1,500 for the roll-paper model and $1,710 for the tractor-feed model. OEM discounts are available, the firm said from 111 Gaither Drive, 08057.

SA Delivers 10,000th Disk Drive

SUNNYVALE, Calif. – Shugart Associates (SA) has announced the delivery of the firm's 10,000th flexible disk drive unit.

The drive was delivered to Datapoint Corp.

Interdyne Formatter Bows

VAN NUYS, Calif. – Interdyne Co. has announced an add-on formatter card module that makes parallel interfacing to microprocessors and minicomputers easier when employing the IC 2400 digital cassette tape drive.

The single card has the features of the IBM-compatible drive formatters and is compact enought to attach to the drive as a second card and adds only 2 in. to the depth. It provides serialization and deserialization of 8-bit byte data, preamble and postamble generation and stripping, bi-phase (Manchester II) encoding and decoding and request/acknowledge handshaking (Tristate).

30% Faster Than Model 7/16

Interdata Enters Low-End Processor

OCEANPORT, N.J. – Interdata Inc. has announced a 16-bit processor at the low end of its product line. The company said the unit costs less than the comparable Digital Equipment Corp. (DEC) PDP-11/04 or 11/05, or the Data General Corp. Nova 3.

Called the Model 6/16, the minicomputer is said to be 30% faster than the compatible Interdata Model 7/16. It is also lower in price, an Interdata spokesman said.

While the 8K-core version of the 7/16 costs $3,200, the comparable 6/16 costs $2,800, a spokesman noted. The 7/16 will, however, continue to be in production.

The Model 6/16 is available in either core or MOS memory. It is program- and interface-compatible with the entire Interdata computer line and can run any of the company's operating systems, a spokesman said.

Core memory cycle time is 1 µsec. MOS semiconductor memory cycle time is 500 nsec. Maximum memory capacity is 64K.

The Model 6/16 includes a task-oriented, 104 instruction set; 16 general-purpose registers, 15 index registers, four high-speed direct memory access channels and vectored hardware interrupts to handle up to 225 I/O devices.

Instruction times range from 900 nsec for register-to-register operation to 10 msec for fixed-point multiply with an optional multiply/divide feature.

The 6/16 is available in an eight-slot chassis with 25 amp or 50 amp power, Interdata said. A 16-slot, 50-amp version is also available.

The Model 6/16 can also be field-expanded to a compatible 32-bit Model 7/32 computer, the spokesman said.

Software includes OS16MT2, a real-time-based multitasking multiprogramming operating system; OS Assembler; Fortran IV and V; OS Aids, an interactive debug program; and CAL, a common assembly language for all Interdata processors.

Interdata also offers a Basic interpreter that is a superset of Dartmouth standard and OS edit, a text editor.

The 8K-byte core versions cost $1,736 in quantities of 100 and are immediately available. The 6/16 processor with 8K bytes of MOS memory costs $1,364 in quantities of 100 and will be available next spring.

Interdata is at 07757.

Disk Drive Available From GIC

HAWTHORNE, Calif. – A head-per-track disk memory has been introduced by General Instrument Corp. (GIC) that costs $3,985 for 1M bytes of memory.

Called the Series 700, GIC's random-access disk drive will be offered in increments of 32 tracks up to 128 tracks. It will feature an average access time of 8.5 msec, 3,600 rev/min and a data rate up to 4.5 mHz. Capacity is up to 19.2M bits.

The Series 700 uses a modular design concept. It is a completely self-contained system packaged in a 7-in.-high rack-mounted chassis. It fits a standard 19-in. EIA rack.

Head assemblies are interchangeable. They can be replaced in the field without optical interlacing alignment, the firm said. Seventeen-track recording assemblies are located on both surfaces of the disk.

Track sparing is manual and two prewritten clock tracks are provided. One head is active, one inactive, giving users an available spare clock track.

Another feature is the filtering technique. Positive clean air is circulated through the disk and recording areas while the disk is rotating.

Air enters the front of the drive through an absolute filter and is directed to the center of the drive.

Three circuit boards are used. Each can be tested independently. They include digital circuits, analog circuits and power supply. The intercoupler circuit is mounted on the board at the rear of the drive and takes virtually any interface. Daisy chain is done in a multiple drive configuration, according to the firm at 13040 S. Cerise Ave., 90250.

Lower Cost/Bit Reduces Price on V76

IRVINE, Calif. – A 62% price reduction in equally equipped computer systems resulted when Varian introduced its V76 computer featuring an $8,900, 64K-word, 600-nsec semiconductor memory.

The $45,550 reduction is the difference between a V73 computer with 128K words of 660-nsec core memory plus memory management system for $74,000, and the V76 computer with 128K words of 660-nsec semiconductor memory including CPU, power supply, memory management system and options for $28,450, Varian said.

Memory is the key with 64K words on a single board and the use of 16-pin, 4K, N-channel MOS random-access memories (RAM) which bring the cost per bit down to 85 cents. Lower power consumption and high packing density of these RAMs combine to significantly reduce power supplies and chassis requirements, the firm said.

This dual-ported memory comes in 32K-word and 64K-word increments and is available with or without parity. The 32K modules sell for $4,800, and parity options are available for $500 per 32K words of memory.

V76 computers are fully software-compatible with all other V70 series computers, though the latest memories are available only in V76 models, the firm said.

The V76 includes memory parity logic, expanded instruction set with byte manipulation, multiply/divide, automatic bootstrap loader for Teletype, I/O bus with direct memory address and programmers console and is available in a 7-in. or 14-in. chassis. Both sizes permit memory expansion up to 256K words in the basic computer chassis.

(Continued on Page 24)

Varian V76

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Conversion Not Easy Process, But Firm Pleased With Results

By Mal Stiefel

Special to Computerworld

TACOMA, Wash. – The Pacific Northwest headquarters of Reichhold Chemical, a manufacturer of synthetic resins and industrial chemicals, is in the process of converting its programs and files from a five-year-old Hewlett-Packard (HP) 2000-based business system to a faster HP 3000 configuration.

The older installation, purchased jointly with systems/software/time-sharing house Computer Solutions, Inc. (CSI) of East Orange, N.J., replaced Reichhold's tab room operation to accommodate the company's increasing data processing load in 1970.

CSI helped Reichhold get started by writing programs for the initial inventory and payroll applications; CSI also used the system in its time-sharing service bureau operation. Reichhold became full owner of the equipment when CSI closed its Washington office.

Rather Switch Than . . .

The decision to switch was made when Reichhold began running out of disk space for many applications, especially in time-sharing mode, according to Lorraine Franich, DP supervisor.

Management had considered additional drives for the 2000, but when it began to dig into the situation, more problems were unearthed.

For one thing, Reichhold had been experiencing difficulties with the flock of vendors maintaining the hardware: HP for the CPU, card reader, magnetic tape drive and paper tape unit; Information Storage Systems for the disk drive; and Sorbus, Inc. for the Data Products printer.

Sorbus had trouble servicing the printer because its personnel weren't familiar with it, Franich said.

She also cited unexplained CPU crashes which forced the operators to reenter the day's work onto a backup disk pack.

For another thing, users found they couldn't run batch and time-sharing jobs simultaneously, so batch work had to be run by the second shift programmer.

Nevertheless, management "was satisfied with Hewlett-Packard, and it had what we wanted," Franich explained. Thus, the company spoke with other minimakers, but decided to remain with HP.

Paper to the Rescue

Some revealing and annoying difficulties have arisen in the conversion process, begun two months ago. The only feasible medium for data transfer from the old disk packs to the new has been punched paper tape.

Apparently, neither the tape drives nor the disks on the two machines are electrically compatible, the old system didn't have a card punch and no one was found who could help with a 2000 disk to 3000 disk copy.

So Reichhold had to settle for the paper tape technique and it has had to spend some time and effort correcting errors introduced by the tape punch.

Source programs written in Basic have been converted with minor changes in job control instructions. The programs written in HP 2000 machine language haven't been converted yet, but Franich doesn't anticipate any significant problems, except for the expected editing by the tape punch.

Future applications on the HP 3000 will include accounts receivable and accounts payable in addition to the payroll, inventory and sales applications and various calculation programs used by Reichhold's engineers.

The company is planning to replace its home-grown payroll package with one sold by HP.

V76 Lower Cost/Bit Reduces System Price

(Continued from Page 23)

The 7-in. chassis models sell for $5,400, and 14-in. models sell for $6,000. Both prices are for quantities of one, and deliveries are scheduled for the first quarter.

The memory with its 4K RAMs is designed for compatibility with future 16K RAM devices – permitting a four-fold capacity increase. Mostek, National and Fairchild supply the 4K RAMs.

Further memory-related product announcements are anticipated early in '76 from 2722 Michelson Drive, 92713.

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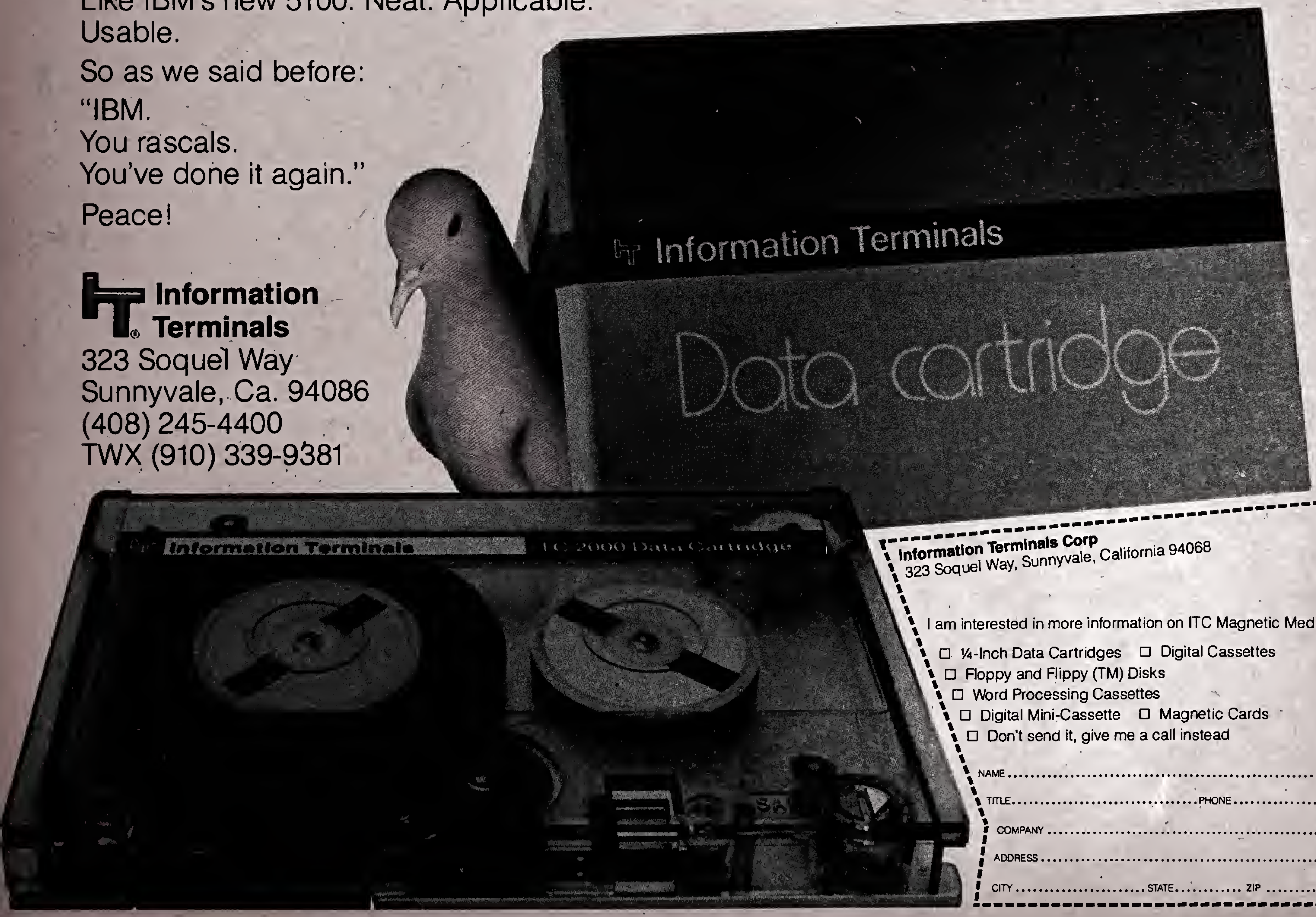

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Mini-Based Net Processes, Stores and Transmits ECGs

MARSHFIELD, Wis. – A mini-based data communications network has gone into operation at Marshfield Clinic here to process and store several hundred electrocardiograms (ECG) each day.

Approximately 50 to 70 of the ECGs are generated at Marshfield Clinic itself; the remainder are transmitted over telephone lines from several remote sites throughout Wisconsin. Even though the computer center is in an adjoining room, the Marshfield ECGs are transmitted in the same fashion as the ones from the remote sites.

Developed at a cost of $250,000, the network is intended primarily as a service for local medical agencies which provide the clinic with referrals. Participating agencies pay a minimal charge per ECG for the services of the network and Marshfield Clinic's seven cardiologists, who read the computer analyses of the ECGs to check their validity and add comments on any abnormalities or situations requiring special treatment.

Systems-engineered by Marquette Electronics of Milwaukee, the network centers around a Model 70 minicomputer from Interdata, Inc. Analysis of the incoming ECGs is done by a Mayo Clinic program designed by Dr. Ralph Eugene Smith.

Faster Than IBM 360

Although the Mayo program used at Marshfield is the IBM 360 version, according to Marquette systems development manager, Mike Schwartz, the minicomputer executes the routine faster than several different configurations of the much larger IBM mainframe.

The Mayo program utilizes 34K bytes of core memory in the Model 70, along with 16 overlays, and runs in 15 to 25 sec, depending on the number of the ventricular complexes.

The same program executed on an IBM 360/30, using 64K bytes of core memory, takes 50 to 65 sec. On an IBM 360/40, the Mayo program runs in 45 to 55 sec, and on an IBM 360/50 in 20 to 40 sec.

"We can process data faster than we can acquire it," Schwartz said. "We have a software routine to queue incoming ECGs on our Diablo disk, but that capability was designed into the system at a time when we thought the Model 70 would take a minute or longer to run the Mayo program. We now find that we don't need a queuing capability."

In operation, the Marquette system at Marshfield Clinic begins with the medical technician attaching electrodes to the patient, then dialing into the system.

After hearing a signal that the computer is available and on the line, the medical technician presses a button to transmit patient information, including an identification number, date, age, weight, height, sex and any prescription drugs the patient may be taking.

Another signal acknowledges receipt of the patient information and cues the technician to set the switch on the Marquette Series 2000 C-209A Patientransmitter for automatic transmission of 20 sec of ECG data in a three-channel format.

Simultaneously, with the transmission of this data, the unit produces a hard-copy tracing for on-the-spot examination by the local physician.

When it arrives at the computer center in Marshfield Clinic's cardiology department, the three-channel signal is recorded on an analog tape recorder, which is linked to a Marquette C550 writer/printer. The C-550 generates a second hard-copy tracing.

The analog tape recorder offers redundancy to the system front end; in the event of a computer problem, incoming ECGs are recorded in analog form and saved for batch processing when the computer is back on line.

An analog-to-digital converter in an adjoining Marquette S7100 card recorder simultaneously feeds the digitized data to the Mayo program in the mini and to the card recorder for generation of a magnetic data card.

Two magnetic strips on the card retain the three-channel ECG tracing, the analysis by the May program and any comments added later by a cardiologist.

When reading the line printer's output, the cardiologist jots down his comments directly on the hard copy produced by the line printer. Later that day, a secretary transmits comments on a Transistor Electronics Corp. CRT terminal for incorporation back through the computer to the S7100 card processor.

Western Digital Adds MCP-1600 Micro

NEWPORT BEACH, Calif. – A 16-bit, N-channel silicon-gate microprocessor has been introduced by Western Digital Corp.

The MCP 1600 microprocessor can be microprogrammed for control applications or programmed to emulate popular minicomputers, "the main target of bipolar slice technology," according to the firm.

Originally developed as the chip set for Digital Equipment Corp.'s LSI-11 microcomputer, the MCP 1600 internally processes data words in 8-bit segments even though it has been designed as a 16-bit machine. The processor consists of the CP 1611B data chip, the CP 1621B control chip and the CP 1631B microinstruction control read-only memory (Microm) chip.

The three chips are interconnected by an 18-bit microinstruction bus that provides bidirectional communications between the chips for addresses and microinstructions. An additional data access uses a 16-bit port for communicating with memory, I/O devices and other system components.

The CP 1611B data chip includes the arithmetic logic unit and 26 8-bit registers. Address generation for fetching microinstructions and control signals for the data access bus is supplied by the CP 1621B control chip.

Four external interrupts and three internal interrupts are provided on the CP 1621B control chip along with seven system control lines. All operations of the MCP 1600 microprocessor system are under the direct control of this chip.

The basic MCP 1600 three-chip microprocessor set is priced at $159 in 100 to 999 quantities. The microcontroller board is $672; the writable control store is $480; the programmable read-only memory store board is $192; and the interface board is $144, the firm said from 3128 Red Hill Ave., 92663.

Meet the new
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With Message-Switching System

Police Check Traffic Violators' Vehicles in Seconds

STOCKTON, Calif. – If you get stopped for a traffic violation in San Joaquin County, Calif., you may have to pay a fine, but at least you won't have an embarrassing 15-minute wait by the roadside while the arresting officer radios in for "wants and warrants" on you and your car.

Thanks to a minicomputer-based communications system designed by PRC Public Management Services and the San Joaquin Sheriff's Department, a complete vehicle check can now be made in seconds.

In fact, before he even pulls you over, the deputy will probably already have requested and received the information that your car was neither stolen nor used in a recent crime.

The high-speed message-switching system links officers in 15 to 25 police cruisers to detectives and dispatchers at headquarters and allows them to access data in the Police Information Network (PIN), the San Joaquin County Univac computer, the various agencies with the California Law Enforcement Telecommunications System (Clets) and – through Clets – the FBI.

Sheriff's department officials estimated that there are approximately 5,350 data entries and inquiry/response transactions between the system and these data sources daily.

Video Receivers Faster

Current field tests have shown that mobile video receivers in police cars can provide even faster responses to inquiries than are possible via conventional radio. Furthermore, video display has the advantage of greater message security by effectively eliminating voice or hard-copy interception by unauthorized persons.

The computer can also hold up simultaneous messages and broadcast them serially to the cars for whom they are specifically intended.

At the center of the system are two Digital Equipment Corp. PDP 11/40 computers, disk drives, a tape drive and console teleprinter, as well as a line printer and other necessary peripherals.

Video, Hard-Copy Terminals

The central system at police headquarters here supports both video and hard-copy terminals at police agencies throughout the county, and plans exist for extending the system into adjoining counties.

One of the major problems in systems dealing with sensitive material is security, especially when those systems are designed – as is San Joaquin's – to be operated quickly by means of prompting information and standard video masks (programmed forms with blanks to be filled in) by persons with no special computer training.

The problem has been handled by allowing only selected terminals access to certain types of restricted information. All other terminals are locked out by coded programs.

Unattended terminals are automatically shut off from the system and – when required by emergencies or schedule changes – terminals can be turned off or on from the central control console in the computer room.

Should a security violation occur at an unauthorized terminal, the incident is automatically logged with the time of day and the terminal identity.

Further, if the security "key" of the inquiring terminal does not compare with the "lock" of the requested transaction, an alarm message is printed on the control console.

High School Upgrades System With Addition Of Floppy Package

SUNNYVALE, Calif. – A small high school, which four years ago was one of the first in Northern California to install an educational computer, recently upgraded its system with the addition of a floppy disk memory package.

Oroville High School purchased an Advanced Electronics Design (AED) 3100P subsystem to add up to 1 million bytes of data storage to its Nova computer. Students and instructors access the system through any of the five teletypewriters or two CRT units.

A floppy disk system contains all electronics and four drives in a single cabinet. A programmable formatter permits each drive to read or write in different formats.

It is possible, for example, for one drive to contain the minicomputer operating system written in 256-word sectors while other drives process IBM-compatible 64-word sectors.

The high school installed its first computer in 1971. Since then they have operated entirely from punched tape stored at a central location.

Can Expand Library

With the addition of the floppy disk subsystem, its instructional library can be greatly expanded. Likewise, the size and simplicity of the diskettes that hold the data will allow departments, teachers or even students to maintain their own files.

A high percentage of the school's 1,200 students are now involved with the computer. In addition to teaching computer science itself, the facility is used for instruction in mathematics, science, English, social science music and art.

Even the physical education department is using the computer's statistical capability for analyzing sporting events.

With the memory storage unit, it will now be possible to carry out programs involving volumes of data that were not possible before. For example, the sociology department might want to manipulate large stores of facts on population behavior patterns. This would have been impractical using paper tape.

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The TMS 9900 Microprocessor

The TMS 9900 is a 16-bit, single-chip microprocessor using MOS N-channel silicon-gate technology. Its unique architecture permits data manipulation not easily achievable in earlier devices. With its repertoire of versatile instructions and high-speed interrupt capability, the TMS 9900 microprocessor provides computing power expected from a 16-bit TTL computer.

The Model 990/4 Microcomputer

It's a complete computer on a single printed circuit board using the TMS 9900 as its central processor. The 990/4 is ideally suited for terminal control, peripheral device interface control, and as a CPU for OEM customers.

In addition to the TMS 9900 microprocessor, the 990/4 microcomputer contains up to 8K bytes of dynamic RAM, up to 2K bytes of static RAM and/or PROM, eight vectored interrupts, front panel interface, real-time clock input, two I/O buses for low- and high-speed devices, and optional ROM utilities.

With the 990/4, you can select a low-cost OEM package, a 7-inch or 12¼-inch rack-mountable chassis, or a table-top enclosure . . . and memory expansion to 58K bytes.

Price: The Model 990/4 microcomputer with 512 bytes of memory is only $368* without chassis and power supply. This same model with 8K bytes of memory is only $512*.

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The most powerful member of the family is the Model 990/10 general-purpose minicomputer. The 990/10, a TTL implementation of the 990 architecture, provides the high-performance speeds demanded in many applications.

A memory mapping feature providing memory protection and privileged instructions supports memory expansion to two million bytes. And TILINE**, an asynchronous high-speed I/O bus, supports both high-speed and low-speed devices. Chassis options are the same as those for the 990/4.

Price: With 16K bytes of memory, chassis, power supply and programmer's panel, the Model 990/10 minicomputer is only $1968*.

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Cost for the seminar, including continental breakfasts and luncheons and all course materials is $250.

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John W. Brackett, PhD, Vice President of SofTech, Inc., will lead this two-day seminar for technical managers on the state of the art of Software Engineering. Under his direction you will learn how to: create more precise and visible analysis and design; reduce integration problems; improve software reliability; incorporate visible outputs into the software development cycle; increase programmer productivity; and improve programming management methods. Topics covered include: Structured programming; Top-down analysis, design, implementation; and Chief Programmer teams. Cost for the entire seminar, including continental breakfasts, luncheons, and all course materials is $300. Additional registrants from the same company are charged only $250.

New York	**Essex House**	**Jan. 26-27**
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Wash., D.C.	**Stouffer's National Center Inn**	**Apr. 6-7**

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Given in association with Leo J. Cohen and Performance Development Corporation, this three-day seminar is a package-independent examination of the techniques required for the design of effective data base systems. The seminar covers Effective Record Design, Physical Storage Techniques, Optimum File Organization/Indexing Techniques, File Integration, and much more.

Cost for the seminar, including course materials, continental breakfasts and luncheons is $350. Additional registrants from the same company qualify for a reduced rate of $300.

Denver	**Denver Hilton**	**Dec. 1-3**

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Under the instruction of Roy N. Freed, a nationally known lawyer, author and educator in the field of computer law, you'll learn how to increase your advantage in dealing with vendors that supply your installation. As well as practical discussion and review of your own contracts, subject areas covered in this 2½-day seminar include: Negotiations, Contracts, Warranties, Avoidance and resolution of disputes, Security, Fraud, Taxation, and Techniques for handling any transaction. Cost for the entire seminar, including continental breakfasts, luncheons and all course materials is $325. Additional registrants from the same company are charged only $275.

Wash., D.C.	**Marriott Crystal City**	**Feb. 4-6**
Orlando, Fla.	**Sheraton Towers**	**Feb. 18-20**
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Wema Panel Assesses Peripherals Market Strategies

By Toni Wiseman
Of the CW Staff

MONTEREY, Calif. – In most areas of the peripherals business, the key to success is to "take a bead on the market you want, concentrate and go for it," Pertec President Ryal R. Poppa said here recently.

Although IBM lately has been segmenting products into smaller market areas, peripherals companies can succeed by taking aim, he said.

Sycor, Inc. President Sam Irwin said that being a specialized company has advantages.

"If a company is going to remain competitive, it will require the shortest possible reaction time for everything from marketing to planning, including service and training. Only small companies can be responsive in such a dynamic situation," he said during a panel discussion called "Computer Peripherals: How Serious is the New Competition?" at the Western Electronics Manufacturing Association (Wema) annual conference here.

In the current environment within intelligent terminals, "new applications are demanded and devised rapidly, many times more rapidly than we as manufacturers can accommodate and certainly more rapidly than our larger contemporaries can react to them," Irwin said.

As an example, he said that IBM documents uncovered in the Telex case showed IBM instituted a crash program to combat Viatron Computer Systems Corp.'s offering. Four years later, he observed, the 3740 arrived.

Poppa called the terminal market "the closest thing we have to a free market in the computer industry. It's relatively cheap to enter, but it's a very large market . . . However, the entry cost of marketing is often underestimated and the entry cost of software is always vastly underestimated," he said.

Poppa said he sees no logical way in which IBM can effectively curtail or stop the independents in this market. "The 3740s, 70s and 90s have not done the job IBM had hoped," he said.

"At Pertec, we've concluded there has really not been a step-up in technology that has resulted in the replacement of installed units," he said.

"Rather there has been a proliferation down many paths ending up in different segments of the marketplace, which serves to effectively segment the market into smaller compartments than previously existed."

This, he noted, is a healthy strategy for IBM since it narrows the target competitors can shoot at. In the disk drive area, for instance, the compartments are defined by capacity, in part by price and in part by formatting, and IBM has attempted to relate capacity more to the CPU demand than it ever has in the past.

"As a result, the 3330, 3332, 40 and 50 are ending up in different market segments," thus shrinking the targets for competitors, who are forced to sharpen their aim for a larger percentage of the market, he said.

Alternatively, the competitor has got to "proliferate himself, go down some of these other avenues and attack other markets. And that costs a lot of money. Most of us who might attack that market don't have those kind of dollars to work with."

Pertec is using proven cost-effective technology; "that means last year's IBM technology," he said. "We do that consciously because we don't want nor can we afford to spend leading-edge development dollars. Instead, we wait to be sure it works and is accepted and then try to offer something more cost-effective."

Evolutionary History

Jesse Aweida, president of Storage Technology Corp., said the history of large or high-performance peripheral systems has been more evolutionary than revolutionary, reflecting more capability, lower cost and greater reliability.

When a device comes along which is revolutionary in nature, and therefore requires a good deal of conversion, people don't jump to it.

Users want more throughput or I/O or whatever the new product offers, he said, but they want to be able to use it under their current operating system.

When IBM offers a new product, it slows down sales for independents, Aweida said, because the users tend to stop and evaluate the market, waiting to see how the new product works before they either order it or continue with the gear they had originally planned, Aweida

(Continued on Page 30)

Tougher Antitrust Laws Needed

Court Should Take Consumer's View: CIA

By Molly Upton
Of the CW Staff

WASHINGTON, D.C. – Courts should consider the supply-substitutability issue in antitrust cases from the view of the consumer rather than the supplier, Computer Industry Association (CIA) President A.G.W. (Jack) Biddle testified at a House of Representatives subcommittee hearing here.

In presenting amendments to the Predatory Practices Act of 1975 proposed by the Justice Department, Biddle explained the CIA is attempting to include "not only predatory practices which many of our members have suffered over years of competing in a single-firm dominated industry, but also those with which we have become familiar through three intense years of litigation watching."

The underlying issue in the Telex vs. IBM case was relevant market, and the reason for the difference in the decisions by the District Court and the Court of Appeals was that the District Court viewed the market from the consumer's perspective while the other took the seller's view, Biddle told the Small Business Committee's ad-hoc subcommittee on antitrust, the Robinson-Patman Act and related matters.

"Although developed in the record, it is clear that the Appeals Court failed to grasp the realities of the marketplace and consider the actual choices available to consumers, as against the theoretical possibility of supply substitutability on the seller side," he said.

In proposing the Predatory Practices Act, the Justice Department is considering either replacing the existing Robinson-Patman Act or combining the two, one observer said.

The CIA would include in the Predatory Practices Act of 1975 language that forbids a company from making threats against creditors and shareholders of a competitor as well as direct threats against the competitor.

"Threats made indirectly through a competitor's creditors or majority shareholders can have the same anticompetitive consequences as those made to the seller, since they go directly to the source of the seller's authority and financial power," Biddle said.

Leased Equipment Included

The CIA would include leased equipment in the section dealing with unreasonably low prices.

Biddle proposed legislation that would forbid further use of IBM's tactic of repackaging an existing product, lowering the rental price below that charged for other similar IBM devices and offering this product to those customers who were considering the lease of a competitive product.

The clause reads it shall be unlawful "to sell or lease replacement or add-on commodities or services to the seller's existing customers on a discriminatory basis where the discrimination systematically favors customers for which the seller faces actual competition."

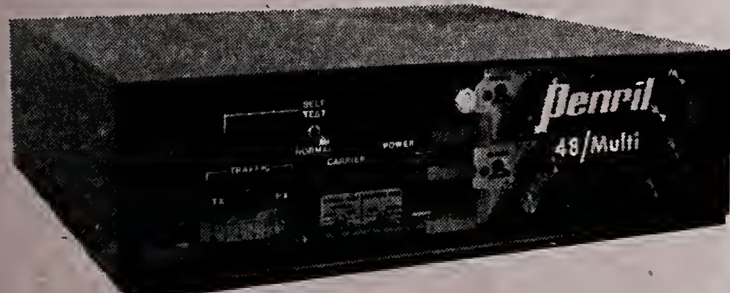
As included in Biddle's definition of terms, "replacement or add-on commodities" is meant to include "those commodities which enhance the performance or function of the commodity or service previously sold or leased to the consumer as recognized by consumers of that commodity."

Although the Predatory Practices Act would permit new entrants to charge lower prices in some instances, the CIA would prohibit a firm which is repackaging a product through bundling technology, integrating components and subsystems from being classified as a new entrant.

The Predatory Practices Act reaches practices not included in the Robinson Patman Act, an observer said. Justice seems to be trying to outlaw certain practices by the Predatory Practices Act without requiring proof of such a high level of anticompetitive restraint as does the Sherman Act, he added.

In making his presentation, Biddle told

(Continued on Page 30)



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Peripherals Mart Strategies Assessed by Wema Panel

(Continued from Page 29)

said.

"The only way you can keep sales up during a period like this is if you have demonstrated to the customer that you have the technology, that you can compete, that you have built up credibility in the past and that you can come up in a timely fashion with devices which can compete with what IBM has just offered," he said.

Another point to consider, Aweida added, is that there has yet to be a product announcement claiming maximum capability, so anytime a company is designing seomthing new, it has to plan for that "midlife kicker" which will give the user an improvement or more for less.

Bob Howard, president of Centronics Data Computer Corp., said it is healthy for the industry to direct itself to the competitive moves of the larger companies; otherwise, the industry becomes sluggish.

The threats to small companies from large ones come in several categories, Howard said. The large companies, for instance, become suppliers of the total system, including all peripherals.

"They are also now offering total system integration which really could disguise price cuts on subsystems, peripherals and components which makes price comparisons extremely difficult," he said.

In addition, the interdependency of devices makes plug compatibility very difficult and, in some cases, impossible for small companies, he noted.

Problems Raising Capital

"The small companies, because they specialize, sell either software or hardware, not total systems," Howard said. "They have a far greater problem with raising of capital, they have to control demands for business expansions, have to keep up with technological improvements and with customers becoming more and more demanding."

But the big problems for small companies, he said, is the lack of de-facto standards in the industry. The large companies such as IBM make their own standards for their own economic purposes, and the little guys have to follow along.

On the more positive side, however, the opportunities for small companies are great, Howard said. Users are becoming more sophisticated and buy what they need, not what the vendor tells them to buy. The concept of multiple vendors is a definite asset in the competitive market.

Unlike a large company, the small company can satisfy the unique features required by the user in his system configuration, he said.

Antitrust Court Should Take Consumer's View, CIA Says

(Continued from Page 29)

the subcommittee "our original antitrust laws were too vague in their intent to restrain today's giant corporation.

"The development of the multiproduct line/multiindustry corporation has effectively moved most of the giant corporations beyond the reach of existing law and established legal precedent," he remarked.

Markets Redefined

Because of the lack of hard data on the size and structure of a number of the major sectors of our overall economy, attorneys defending corporations accused of antitrust violations "can and do define and redefine the relevant market to suit the situation – and they get away with it time after time."

Using the supply substitutability criteria of existing case laws, monopoly firms can contend that any other giant corporation could, if it wished, enter its market and compete.

"One of the weaknesses of the Robinson-Patman Act is that it assumes companies are relatively equal in the beginning, when in fact they are not," Biddle said.

As examples, he cited actions by AT&T and IBM to cut prices on certain products and compensate in other product areas.

AT&T "virtually destroyed the fledgling specialized common carrier industry by lowering prices where it faced competition from the new entrants and offsetting the loss by raising prices where its monopoly services are immune from attack," he said.

IBM acted similarly when it lowered the cost of memory and raised the price of the central processor. IBM was still able to show a profit on the price of the memory, he observed.

Big Firms Use Loopholes

The Robinson-Patman Act "cannot effectively deal with the monopolist who can, with impunity, lower prices below the previous monopoly level – but not below 'costs' – drive out the smaller competitors and then return to monopoly price levels," Biddle said.

"Also, today's multiproduct/market giants can circumvent the intent of the antitrust laws by hiding their anticompetitive strategies and predatory practices behind the guise of technological necessity" – such as IBM's moving the controller into the CPU, he said.

U.S. vs. IBM Trial Reports Available on Infonet Net

WALTHAM, Mass. – International Data Corp.'s (IDC) reporting service on the U.S. vs. IBM antitrust trial is available through the Infonet network.

The new communications arrangement will allow longer, more detailed reports of testimony, motions and documents, according to William Leitch, IDC vice-president.

Subscribers can also access reports filed within the last month and will have access to other trial-related data bases now under construction, he said.

Subscribers to the daily service can access the network via terminals in their offices. Prices of the service is $60/week. IDC is at P.O. Box 915, 02154.

Wake me when it's over

Read the Year-End Review and Forecast, a special Supplement in the December 31st/January 7th combined issue of Computerworld.

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Edited by Drake Lundell, this special issue will review all the big stories in the 1975 computer world - from developments in hardware, software and communications to changes in computer law and the impact of computers on society. It'll be an excellent overview of what's happened, combined with some knowledgable forecasts of what's going to happen in 1976. And if you have anything to do with computers, you should be there on December 31st.

If you're a DP marketer, remember the closing date for this special issue: December 12th. Contact your *Computerworld* salesman for complete details. Or call Judy Milford at (617) 965-5800.

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DP Groups Name New Officers

'Tis the season for association elections and appointments, and a raft of them have come in, with a new president at the Association of Data Processing Service Organizations (Adapso) and chairman at Computer Business Equipment Manufacturers Association (Cbema).

Weisburgh Leads Adapso Slate

MONTVALE, N.J. – Adapso has a new slate of officers to lead it through 1976, headed by President Leon Weisburgh, president of Anstat, Inc. of New York.

Weisburgh will be assisted by Louis Pfeiffer, Data Systems Division, A.O. Smith Corp., as first vice-president and Edward Horst, Comtech, as second vice-president.

Adapso's Data Center Section has elected Jack Williams president. Williams is president of Unitab Co. Serving as vice-president is Roland Smith, president of Computer Services Corp.

The Remote Processing Services Section of Adapso named Curt DeForest as president and John Skodon as vice-president.

The Software Industry Association reelected Lloyd Baldwin president. Baldwin is president of Lloyd Baldwin & Associates. Bruce Coleman, president of Boole & Babbage, Inc., is vice-president.

Tabat Presides at Cbema

WASHINGTON, D.C. – Cbema's new chairman of the board is E. Lawrence Tabat, president of Dictaphone Corp.

Tabat succeeded Gerald G. Probst, president of Univac.

Maurice A. Longsworth, director of licensing and export at Honeywell Information Systems, is chairman of Cbema's Data Processing Group.

CLA Names Technical Head

WASHINGTON, D.C. – The Computer Lessors Association (CIA) has named Orville A. Wiseman chairman of its technical committee, which is responsible for implementing national programs for enhancing systems owned by CLA members.

IBM Seen Meeting 1975 Goals

EAST FISHKILL, N.Y. – IBM's operating divisions should "meet their objectives" by year-end or "come close to them," Chairman Frank T. Cary told security analysts here recently.

Despite increased costs and other factors that have put pressure on profit margins, overall "we feel our business is improving," Cary said.

Backlog for DP equipment is about the same as at the end of 1974, he said. Although shipments and installations of equipment are lower than a year ago, they continue at a high level, he added.

Outright sales of DP products have steadily increased during 1975, although they are still below the 1974 level, according to B.H. Witham, treasurer.

This is partly attributable to an increase in purchases by users who had been renting the equipment, he said.

Cary called the computer industry "still very young and dynamic" and said it would remain a growth industry – along with word processing – for a "long time to come."

Much of that growth will come from small firms that are not users now, he said. "There appear to be no limits to how far we can push technology or to new applications of our products," Cary added.

Witham indicated IBM's profit margin for the first nine months was 22.8% compared with 24.4% for all of 1974. However, he added, each quarter has been improving, with the third-quarter rate reaching 23.6%.

In the present recession, Cary observed, users have not been returning rented computers as they did in the 1970-71 time frame.

Two Service Firms Expanding Overseas

Interactive Data Corp. and Automatic Data Processing, Inc. (ADP) are continuing the trend toward overseas expansion among service firms.

Interactive Data has opened its first overseas facility in London, which it said will provide all of the firm's products now available in the U.S., including support and use of data bases maintained in Waltham, Mass.

Similar operations are planned for other European countries, according to Jack A. Arnow, president.

ADP Buying Delos

ADP has agreed in principle to acquire The Delos International Group, Inc. for about $7.3 million.

The agreement is contingent upon the signing of a definitive contract and the approval of ADP directors and Delos stockholders.

Delos is a time-sharing firm with offices in the UK and Brussels.

ADP President Frank R. Lautenberg said Delos activities will be integrated with ADP's Cyphernetics Division, which has offices abroad in London and Brussels. Earlier this year, Delos bought the time-sharing business of Applied Data Research, Inc. [CW, May 21] and ADP bought Cyphernetics [CW, Aug. 27].

IBM Files Against Xerox For Patent Infringements

ARMONK, N.Y. – In a turnaround, IBM has filed patent infringement suits against Xerox Corp. charging it with infringing upon its U.S. and Canadian copier patents.

The patent battle between the two firms has existed since April 1970, when Xerox filed against IBM.

The IBM suit asks for injunctions against Xerox and for unspecified damages.

The patents relate to a process which improves the quality of copies and extends the useful life of the photoconductive surface in copiers. IBM said two Xerox copiers use this process.

Tymshare to Acquire Autex

CUPERTINO, Calif. – Tymshare, Inc. has agreed in principle to acquire Autex, Inc., which operates a securities information system principally used by broker/dealers and financial institutions.

The agreement, subject to completion of a definitive agreement and approval by Autex shareholders, calls for an exchange of stock.

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ADR Urges Patenting of Software as Machine System

The upcoming case before the Supreme Court of C. Marshall Dann vs. Thomas R. Johnston has elicited amicus curiae, or "friend of the court," briefs from industry associations as well as private firms.

Summaries are given here of Applied Data Research, Inc.'s brief supporting the patentability of software and the Computer Business Equipment Manufacturers Association's position against software patentability.

WASHINGTON, D.C. – Applied Data Research, Inc. (ADR) has filed a "friend-of-the-court" brief with the U.S. Supreme Court here supporting patenting of software.

ADR argued software is indeed a machine system rather than an idea or a method of doing business.

ADR, which has received patents on some of its software, argued the hardware manufacturers seek to protect their own domains by opposing the patentability of software, as expressed in the brief filed by the Computer and Business Equipment Manufacturers Association (Cbema).

The hardware manufacturers, the ADR brief continued, "have obtained patents for their hardware programming developments; these are the products they price in the bundle of hardware and software they sell.

"However, the hardware manufacturers do not wish to be restrained in any way by software patents companies such as ADR may obtain; for such patents would enable small software companies . . . to enter into competition with the hardware manufacturers even as against the 'free' software," ADR said.

"The hardware manufacturers, which have substantial monopoly positions in the software they supply with their hardware, seek a registration system for protection of the noninnovative features of their software and would deny to innovative competitors the incentive that is the basic rationale of the patent system," the ADR brief stated.

"Besides stimulating innovation, patent protection will enable other small software companies to compete with the hardware giants, as it did amicus ADR. It will end the reliance on trade secrets as the only means to protect innovative software, which has had the effect of inhibiting the free flow of information," ADR continued.

The brief attacked the suggestions by those opposed to the patentability of software that adequate protection could be granted by copyright.

"A registration system (whether copyright or otherwise) is intended to protect noninnovative features of the machine system embodied in the detailed coded instructions of the software.

"Such protection is clearly proscribed by the constitution," the brief said.

"Furthermore, that proposal would have the constitutionally innovative features pass into the public domain. Therefore, the constitutional policy of providing an incentive to "innovation" would not be served by the Cbema proposals; it would be circumvented," ADR said.

ADR also observed the Court of Customs and Patent Appeals' findings in prior cases apply here; specifically, software structures general-purpose hardware into a special-purpose computer, the structure of which is then different from the general-purpose machine.

The brief pointed out that, in the case of patents granted to ADR for software, "it is clear that not only is there a machine system distinctly different from a human 'mental process,' but that any patents on these systems would not cover mathematics or prevent the human performance of any 'mental process' or 'method of doing business.' "

Program Only a 'Way of Doing Business': Cbema

WASHINGTON, D.C. – Thomas R. Johnston's software program should not be patented because it is based on an algorithm that is essentially "a method of doing business," according to the amicus curiae brief filed with the Supreme Court by the Computer Business Equipment Manufacturers Association (Cbema).

The brief was filed on the case of C. Marshall Dann vs. Thomas R. Johnston.

Johnston's concept of coding, which is intended for use by banks, is not patentable and does not become so because a general-purpose computer is programmed to perform the "nonpatentable subject matter," the Cbema filing contended.

The filing disagreed with Johnston's position that a general-purpose computer, when programmed with a financial accounting procedure, becomes a machine system and is therefore patentable.

Even if Johnston "had disclosed a hardware implementation for his nonpatentable algorithm," Cbema said, "it should not be patentable if claimed so broadly as to provide patent protection for the algorithm," the brief said.

"Thus, where a computer program is predicated upon a nonpatentable algorithm, the program should not be patentable as a 'machine system' even if it coacts 'synergistically' with the computer," Cbema said.

In this case, however, the court doesn't have to address the issue of synergism since "none exists. The computer is simply being used as a tool to perform the financial banking algorithm developed by respondent," the brief said.

The determination of an invention's patentability must be made by examining the substance of the discovery rather than the form in which it is claimed, the brief held.

The association contended the software industry has shown tremendous growth within the past two years and patents are not needed to promote further growth in the industry. Rather, it is the general absence of patents that has aided the recent growth, the hardware group claimed.

Programming breakthroughs in the last two decades "have by and large taken place in a legal framework conducive to the free interchange of ideas and information . . . This atmosphere of intellectual freedom has contributed significantly to the enormous strides made in the use of computers," Cbema said.

Hardships to Users

Granting patent protection to the originators of algorithms would impose hardships on the user community, since users would have to ensure programs they develop do not infringe any patents, the group said.

The brief further contended copyright laws provide a viable form of protection for marketing computer programs.

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Vendor Climbs Back From Receivership

By Patrick Ward
Of the CW Staff

DON MILLS, Ont. – Consolidated Computer, Inc. (CCI) is probably one of the few firms in the industry that has ever made the climb back from receivership, according to William G. Hutchison, president of the Canadian key-to-disk vendor.

But then, U.S. companies don't have the Canadian government for a godfather.

CCI demonstrated a working key-to-disk system in June 1969, making it one of the first companies to show this type of equipment, Hutchison recalled.

The company launched marketing and field service operations in the U.S. and Canada. English and German subsidiaries followed, as did an OEM contract with International Computers Ltd. (ICL).

"We were right up there with Computer Machinery Corp. and Inforex" at that time, Hutchison said.

Trouble Ahead

But even as sales climbed, trouble loomed.

"We tried to do a stock offering in the U.S. at the end of 1971, but the time was unfavorable," Hutchison said

At about the same time, the company's financial backers lost confidence in the company's president/founder, he said.

By the fall of 1971, CCI couldn't raise sufficient equity to support its increasing debt and went into receivership.

As CCI begin to make the climb back up, the Canadian government guaranteed a lease-financing loan from Ford Motor Credit. The government made good on Ford's claims, Hutchison said, but took over CCI's lease base and sold it back to CCI in exchange for debentures.

The federal and provincial governments also put new operating capital into the company. The debt settlement and new capital made them 52% owners of CCI's stock.

CCI emerged from reorganization and receivership in March 1972. It had sold off both its English and German subsidiaries, but had kept its customer base in North America.

The company also "had not laid off one person in the product development area from the time it went into receivership," Hutchison said.

Lacking the capital for lease financing, CCI came back exclusively as an OEM. ICL soon helped CCI back on its feet with a $7 million order for Key-Edit systems.

The British firm placed another $20 million order in the fall of 1972. Other OEM contracts came from Japan's Fujitsu and Echodata, the Brazilian subsidiary of Britain's Cable and Wireless Ltd.

In mid-1974, the Canadian government agreed to support CCI in its move back into the North American end-user market.

"The government wants to see us grow because it feels Canada can play a role in communications, in data entry front ends or distributed processing and in applications software," Hutchison said.

CCI is the largest native Canadian manufacturer of DP equipment and makes its own mini- and microcomputers, CRTs and keyboards, he said.

CCI first operated under direct government loans to support its leases, but the company is now shopping around for loans from other sources. These would still be 90% government-guaranteed, Hutchison noted.

A year after resuming direct marketing to the U.S. and Canadian customers, business is good for CCI, he said. The company expects $5 million in U.S. sales during 1975 and $8 million in 1976.

About 700 of the 1,000 Key-Edit systems the company has shipped went overseas. "We have about 25% of the key-to-disk business in England, about 65% in Canada and about 4% in the U.S.," he said. The firm's products are used in 28 countries.

Also on the international front, Hutchison said CCI might market Fujitsu terminal products in North America.

Capac Offering Systems Houses Technical Help

RIDGEFIELD, Conn. – Capac, Inc. is offering small minicomputer systems and software houses technical assistance which is normally not available from OEMs when equipment is purchased at discounted prices, the vendor said.

When small systems and software houses purchase minicomputers from OEMs, they are confronted with several problems, said Capac President David H. Brown.

"The smaller houses do not normally have the technical expertise to perform the functions of software support, installation, quality control and field servicing that are necessary to satisfy the end user," he said.

"Therefore, it becomes a question of whether they should give up the discount when buying equipment, in order to get technical assistance from the manufacturer, or to pay up to $35 an hour for servicing," Brown said.

Capac has itswn in-house expertise for hardware and software and can support end users served by other systems houses, he said. This enables others to take full advantage of manufacturers' discounts, he added.

Capac develops and markets minicomputer systems for business applications.

Singer Division Reorganizes

NEW YORK – George R. Cogar, president of the Singer Co.'s Business Machines Division, has completed the reorganizational lineup of the division's top management team. Several officers were formerly executives with the Cogar Corp. subsidiary.

With these appointments, Cogar said, the division is ready to carry out its strategy of consolidating and concentrating its resources and marketing efforts on the growing retail and terminal systems markets.

J.J. Ryan has been appointed senior vice-president of North American marketing, replacing R.W. Casey, former vice-president of domestic marketing. Maynard Smith, who was appointed vice-president of service support, replaces Ryan. Smith had been director of field engineering.

Larry F. Neely was named vice-president of operations for the Albuquerque, N.M., and San Leandro, Calif., operations, replacing R.E. Ward, who is being reassigned. Neely had been vice-president operations for Cogar Corp.

All will report to Cogar except Smith, who will continue to report to Ryan.

In the marketing organization, John Kerin was appointed vice-president of marketing, retail systems, and Henry Donaldson vice-president of marketing, terminal systems. Donaldson was formerly director of marketing for Cogar.

Executive Corner

■ Kenneth J. Whalen has resigned as a director of Burroughs Corp.

■ Control Data Corp. has named Paul G. Miller president of its subsidiary, Commercial Credit Co. Vernon E. Sieling succeeds Miller as executive vice-president of marketing at CDC. Dr. Leroy F. Stutzman and Joseph M. Walsh have been named to CDC's board of directors.

■ Berthold Salz has been appointed vice-president of finance at Computer Transceiver Systems, Inc.

■ James L. Maddox has been appointed vice-president of planning at Computer Consoles, Inc.

■ Stephen Kaplan has been named vice-president of marketing at Computer Operations, Inc.

■ Kenneth B. Fannin has been appointed president of Ball Computer Products, Inc.

■ D. Michael Grimes has been named vice-president of marketing at Identicon Corp.

■ Ted Goodlander and Warren Hayes have been appointed vice-presidents of Wang Laboratories, Inc.'s International Sales Division and Manufacturing Division respectively; Robert Kolk and Harry Rothman have been named vice-presidents of Wang's Development Center Group.

■ Marvin C. Moses has been appointed vice-president of finance at Telenet Communications Corp.

■ Don Nielson has been named vice-president of field service and logistics support of Telos Computing, Inc.

■ Robert P. Wolk has been named executive vice-president of Atlantic Software, Inc.

■ William G. Moore Jr. has been appointed vice-president of Inforex, Inc.

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For Vendor's Own Systems

Boise HP Primed to Make Peripherals

By Molly Upton
Of the CW Staff

NEWTON, Mass. – The prime mission of Hewlett-Packard Co.'s (HP) Boise (Idaho) Division is to provide peripherals that will enhance the sale of HP systems. A very close second is to successfully compete in the OEM market, Bill Murphy, marketing manager, said here recently.

When HP moved to Boise, it found unexpected engineering talent in the area. Many of these people were employed in other industries, such as lumber or cement factories because they wanted to live in Idaho but could not find an electronics firm to work for, he said.

In addition, HP has established several training programs to give people the skills necessary for hiring, he said.

Currently the division makes tape drives handling 1/2-in. tape, the 7970 series, and has a manufacturing license for the Tally Corp. 200 line/min printer.

The division has its own research and development unit, which has led sources to suspect HP will come out with a new printer product, but Murphy was silent on that prospect.

Any future products developed by HP will be oriented toward both the HP and OEM market, Murphy said. HP now OEMs its tape drives, but its Tally license is only for use with HP systems.

There are ways in which the electronics for printing can be improved, he observed. For instance, using a combination of microcomputers and the dot matrix could give a really flexible machine, he said.

For use with HP systems, printers in the range of 200 to 400 line/min are popular, he said.

HP also provides other printers with its systems, such as Dataproducts printers, the GE Terminet and teletypewriters, he said.

Employment Growth

HP Boise currently has about 340 employees, of whom about 62 were transferred from other HP locations, so the division represents real employment growth rather than a transfer of personnel, Murphy said.

Boise was receptive to HP moving in, he said, and the firm has tried to hire as many people as possible locally.

"We found a lot of electronics technicians who were in the area just because they wanted to live in Idaho," he said.

But there was no skilled labor pool in electronics assembly, he said, so HP rented classroom space and set up a training program in basic electronic procedures such as wiring and soldering. In addition, it is working with Boise State University and a junior college to institute technical training programs.

In-house training is offered, including a videotape course from Stanford University for graduate-level engineers. Complemented by HP tutors, the program includes tests that are mailed to Stanford to be graded. HP pays tuition for students.

Offering the opportunity to attain advanced degrees is important for recruiting engineers, Murphy said.

Univac Selects WUIS to Provide Equipment for Educational Facility

MINNEAPOLIS – Univac has selected Western Union Information Systems (WUIS) to provide two C-2100 front-end communications multiplexers and special switching equipment for use in the facility it is developing for the Minnesota Educational Computer Consortium.

Equipment under the contract to WUIS, valued at $250,000, is being delivered and the Minneapolis facility is scheduled to be operative next spring.

The C-2100s will connect a Univac 1100 with 300 communications lines linked to terminals throughout the state.

Orders & Installations

Total Systems, Inc., a DP firm, has ordered Model 2001 savings bank teller terminals from Bunker Ramo Corp.'s Information Systems Division.

Allis-Chalmers Corp. Electronics Operation will install a process control system at Martin Marietta Aluminum, Inc.

Atlas Industrial Co. has ordered a Hewlett-Packard 3000CX mini.

Goldworm, Inc. has ordered an interactive, on-line turnkey Micos minicomputer system from Mini-Computer Systems, Inc.

Sperry Systems Management has ordered two Slash 4 systems from Harris Corp. for use in the navigational training portion of the Navy's Trident project.

The Georgia Institute of Technology has installed a Control Data Corp. Cyber 70 Model 74 computer system and will begin installing a CDC 6400 system to support a multipurpose campus-wide network.

Walter E. Heller & Co. has ordered a Burroughs B4700 system with dual central processors.

The Contra Costa Water District of Concord, Calif., has ordered a mini data center from Hewlett-Packard.

The U.S. Department of Commerce has ordered a Model 204 data base management system from the Computer Corp. of America for the Office of Minority Business Enterprise.

Fred S. James and Co. has installed Burroughs TC 3500 terminal computers in 20 of its 40 offices to establish a nationwide data communications network.

Seattle First National Bank has ordered Incoterm's Series 7000 on-line banking system for use at 1,100 teller locations in the bank's 150 branches.

McDonnell Douglas Automation Co. has ordered two Cyber 173 systems from Control Data Corp.

Lewis Business Forms, Inc. has ordered a Mead Dijit nonimpact printing system.

Expansions

California Computer Products, Inc. has leased 4,746 sq ft in Sequoia Commerce Center, Torrance, Calif., for use as district sales and service offices.

Tektronix, Inc. has relocated its Information Display Group to its 265-acre industrial park in Wilsonville, Ore., 18 miles south of Portland.

Pro-Log, a California-based manufacturer of microprocessor systems, has moved to new quarters at 2411 Garden Road, Monterey, Calif.

Singer-M&M Computer Industries, Inc. is expanding its Orange, Calif., manufacturing facilities an additional 25,000 sq ft to meet increased production demand.

Interactive Data Corp. has opened an office in the Foshay Tower at 821 Marquette Ave., Minneapolis.

Whitlow Computer Systems has moved its corporate offices to expanded facilities at 560 Sylvan Ave., Englewood Cliffs, N.J.

Other Awards

Shugart Associates has received a contract from Compugraphic Corp. for SA901 diskette drives to be used in Compugraphic's typesetting system.

Identicon Corp. has been awarded a contract from the Library of Congress to supply Model 600 optical scanning equipment for use in a book-processing system.

The Computer Services Division of R. Dixon Speas Associates has received software development contracts from Air New Zealand and Qantas Airways to develop intercontinental computer flight training systems and from Air Canada for a computer-based crew scheduling system.

Contracts

C3, Inc. has been awarded a $12 million contract by the U.S. Navy for 100 minicomputer systems to be used in business and scientific applications.

Teledyne Inet has received a contract from the Social Security Administration for a 400 Hz static uninterruptible power supply system, maintenance and spare parts.

Envirodyne's Olson Laboratories has been awarded a contract by the Environmental Protection Agency to develop exhaust emissions data from 127 late-model "light-duty vehicles."

C3, Inc. has received two contracts from the National Aeronautics and Space Administration to provide 11 minicomputer systems, support and installation training.

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Forward resume to Emil Hallin, Vice President Computer Sciences, National College of Business, P.O. Box 1780, 321 Kansas City Street, Rapid City, SD 57701.

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For further information please contact: Sharon McDonald, Personnel Division, Medical College of Georgia, Augusta, Georgia 30902. (404) 828-3081.

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Loss Tops $47 Million In Nine Months at Wyly

DALLAS – Wyly Corp. reported a nine-month loss of $47.9 million which it said resulted primarily from losses of $37 million from Gulf Insurance Co. and startup losses in Data Transmission Co. (Datran), its data communications service enterprise.

Datran has been achieving good sales of its data communications services in recent months and expects to reach an operating cash break-even point in the second half of 1976 and profitability in 1977, Wyly said.

Since its inception in 1968, Datran has required investment of $86 million in capital and startup expenses, Wyly said.

In the nine months, Wyly's $47.9 million loss compared with a loss of $5.6 million in the year-ago period, which was restated to reflect the sale of computer leasing operations, the Energy Division and Gulf, which is expected to be sold as of Dec. 31.

The 1974 period also was restated to report Datran losses during that period.

Revenues for the firm slipped to $46.8 million compared with $59.7 million in the year-ago period. Datran revenues rose to $926,000 compared with $557,000 in the same period last year.

But data communications services showed a loss before taxes and corporate costs of almost $8 million compared with a loss of $4.9 million in the year-ago period.

For the three months, Wyly posted a loss of $35.9 million compared with a loss of $3.2 million in the same 1974 period.

Revenues slipped to $15.8 million compared with $19.8 million.

The sale of Gulf will eliminate about $30 million of highest interest debt, leaving the firm with long-term debts with interest rates of 4% to 7.25%, Wyly said.

CSC Second-Quarter Earnings Rise

EL SEGUNDO, Calif. – Second-quarter earnings doubled and revenues increased sharply over the year-ago period at Computer Sciences Corp. (CSC).

Earnings for the 13 weeks ended Sept. 26 totaled $1.7 million or 12 cents a share compared with $856,000 or 6 cents a share in the same period last year.

Second-quarter revenues of $53.5 million were a record for any prior quarter and compared with $42.5 million in the year-ago period.

The earnings improvement resulted from continued gains in revenues and profitability from both sectors of the company's business, contract services and the operations of the Infonet time-sharing network, according to William R. Hoover, CSC chairman and president.

For the first half, earnings were $3.2 million or 23 cents a share, up 125% over the $1.4 million or 10 cents a share for the same period last year.

Revenues for the half rose to $103.9 million compared with $82.3 million a year ago.

NCSS Improves In Six Months

NORWALK, Conn. – Although National CSS, Inc.'s (NCSS) second-quarter earnings dipped, the results for the six months were an improvement over the year-ago figures.

For the quarter ended Aug. 31, the firm earned $481,700 or 45 cents a share compared with a restated $489,800 or 45 cents a share in the same period last year.

Quarterly revenue rose to $8.7 million compared with $8.4 million in the 1974 period.

The 1974 figures were restated to conform with a change effective in 1975 in accounting for software and system development costs, the firm said.

During the six months, earnings rose to $993,000 or 91 cents a share compared with $961,900 or 88 cents a share in the year-ago period.

Revenues for the half rose to $17.3 million compared with $16.7 million last year.

Acquisitions

NCR Corp. has acquired **Learning Systems Development Corp.**, a Cincinnat-based company which specializes in the development of training material for the retail food industry.

Control Data Corp. has acquired 100% ownership of **Medlab Computer Services, Inc.'s Medlab/Pathlab** business. CDC previously owned 43% of Medlab's stock.

Itel Corp. has acquired **Capital Business Services, Inc.** for an undisclosed amount.

NLT Computer Services Corp. has acquired the **Management Services for Automatic Data Processing, Inc.** of Philadelphia in an exchange of 40,000 shares of NLT stock for all Management Services stock.

The **3M Co.** has acquired the **Graphic Systems Division** of **Gould, Inc.**

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LOGICON
Three Months Ended Sept. 30

	1975	1974
Shr Ernd	$.24	$.22
Revenue	8,589,000	9,433,000
Earnings	208,000	192,000
6 Mo Shr	.47	.40
Revenue	16,362,000	17,608,000
Earnings	402,000	345,000

GRAHAM MAGNETICS
Three Months Ended Sept. 30

	1975	1974
Shr Ernd	$.20	$.30
Revenue	3,728,361	3,925,696
Earnings	183,942	279,971

MACRODATA
Three Months Ended Sept. 30

	1975	1974
Shr Ernd	.....	$.23
Revenue	$2,818,799	3,267,961
Earnings	(57,650)	229,970
9 Mo Shr	.05	.69
Revenue	8,704,779	9,526,294
Earnings	60,237	646,889

HARRIS
Three Months Ended Sept. 30

	1975	1974
Shr Ernd	$.96	$.60
Revenue	118,660,000	107,129,000
Disc Op	.....	(1,319,000)
Earnings	5,851,000	3,721,000

INFOREX
Three Months Ended Sept. 26

	1975	1974
Shr Ernd	$.10	$.08
Revenue	13,734,000	13,129,000
Tax Cred	.....	53,000
Earnings	297,000	226,000
9 Mo Shr	.21	.06
Revenue	41,462,000	35,633,000
Tax Cred	58,000	53,000
Earnings	602,000	164,000

INFORMATION MAGNETICS
Three Months Ended Sept. 27

	1975	1974
Shr Ernd	$.32	$.04
Revenue	6,149,495	6,003,074
Tax Cred	198,833	.....
Earnings	420,571	52,913
9 Mo Shr	1.17	.32
Revenue	17,719,869	17,264,099
Tax Cred	705,559	.....
Earnings	1,493,159	407,660

ITEL
Three Months Ended Sept. 30

	1975	1974
Shr Ernd	$.33	$.32
Revenue	58,200,000	35,500,000
Tax Cred	.....	a100,000
Earnings	2,700,000	2,800,000
9 Mo Shr	.76	.82
Revenue	139,100,000	104,500,000
Tax Cred	.....	a400,000
Earnings	6,500,000	7,300,000

a-From discontinued operations.

LITRONIX
Three Months Ended Sept. 28

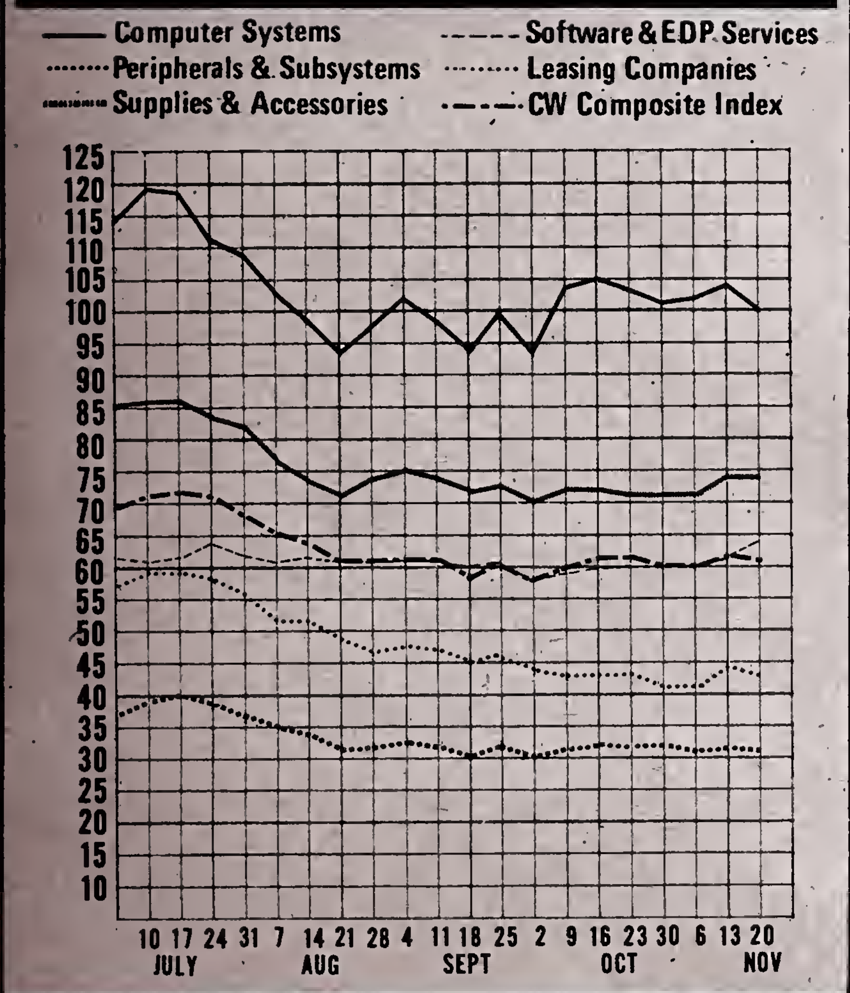
	1975	1974
Shr Ernd	$.12	$.12
Revenue	13,203,000	9,583,000
Tax Cred	.....	105,000
Earnings	294,000	306,000
9 Mo Shr	.29	.14
Revenue	36,866,000	25,029,000
Tax Cred	.....	105,000
Earnings	727,000	347,000

MICRODATA
Year Ended Aug. 31

	1975	a1974
Shr Ernd	$.71	$.41
Revenue	15,944,074	13,829,599
Tax Cred	501,000	265,000
Earnings	1,117,997	641,466
3 Mo Shr	.48	.....
Revenue	5,264,499	4,263,105
Spec Item	c367,000	b(75,500)
Earnings	753,647	(99,610)

a-Restated to reflect accounting change. b-Reversal of tax-loss carryforward. c-Tax credit.

COMPUTERWORLD Computer Stocks Trading Indexes



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TRADE QUOTES

Computerworld Stock Trading Summary

CLOSING PRICES WEDNESDAY, NOVEMBER 19, 1975

All statistics compiled, computed and formatted by
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COMPUTER SYSTEMS

EXCH		PRICE 1975 RANGE (1)	CLOSE NOV 19 1975	WEEK NET CHNGE	WEEK PCT CHNGE
N	BURROUGHS CORP	62-109	81 5/8	+1 7/8	+2.3
O	COMPUTER AUTOMATION	2- 11	10 1/8	+ 1/8	+1.2
N	CONTROL DATA CORP	11- 23	19 1/4	- 1/8	-0.6
N	DATA GENERAL CORP	10- 39	36 1/2	-2 1/2	-6.4
O	DATAPOINT CORP	6- 26	23 3/4	-1 3/4	-6.8
O	DIGITAL COMP CONTROL	1- 4	1 1/2	- 3/4	-33.3
N	DIGITAL EQUIPMENT	46-140	130 1/4	-9 3/8	-6.7
N	ELECTRONIC ASSOC.	2- 3	2 1/2	0	0.0
A	ELECTRONIC ENGINEER.	5- 10	7 1/2	0	0.0
N	FOXBORO	23- 42	28 1/4	+ 1/4	+0.8
O	GENERAL AUTOMATION	4- 14	4 5/8	- 7/8	-15.9
O	GRI COMPUTER CORP	1- 1	1/2	- 1/8	-20.0
N	HEWLETT-PACKARD CO	58-120	95 5/8	-7 3/4	-7.4
N	HONEYWELL INC	22- 40	33 1/4	-2	-5.6
N	IBM	158-225	219 1/2	-5 1/4	-2.3
O	MEMOREX	1- 10	8 1/2	0	0.0
O	MICRODATA CORP	2- 8	7 3/8	+ 1/4	+3.5
O	MODULAR COMPUTER SYS	5- 19	11 3/4	+ 1/4	+2.1
N	NCR	15- 39	23 3/4	- 1/2	-2.0
O	PRIME COMPUTER INC	2- 6	4 1/4	- 1/2	-10.5
N	PERKIN-ELMER	16- 30	25 1/2	+ 1/2	+2.0
N	RAYTHEON CO	26- 59	46 1/4	-2 1/8	-4.3
N	SINGER COMPANY	9- 17	9 3/4	- 1/4	-2.5
N	SPERRY RAND	26- 49	42 1/4	-1 3/4	-3.9
A	SYSTEMS ENG. LABS	1- 5	3 7/8	+ 7/8	+29.1
N	VARIAN ASSOCIATES	7- 18	12 3/4	-1	-7.2
N	WANG LABS.	7- 17	10 5/8	-1	-8.6
N	XEROX CORP	50- 86	50 5/8	-6	-10.5

LEASING COMPANIES

EXCH		PRICE 1975 RANGE (1)	CLOSE NOV 19 1975	WEEK NET CHNGE	WEEK PCT CHNGE
O	COMDISCO INC	1- 5	3 3/8	0	0.0
A	COMMERCE GROUP CORP	2- 4	2 1/4	- 1/8	-5.2
A	COMPUTER INVSTRS GRP	1- 2	5/8	-	-9.1
M	DATRONIC RENTAL	1- 1	1/2	0	0.0
A	DCL INC	0- 1	5/8	+ 1/4	+66.6
N	DPF INC	3- 6	4 1/2	+ 1/8	+2.8
O	EDP RESOURCES	1- 2	1	0	0.0
A	GRANITE MGT	1- 5	4 1/2	0	0.0
A	GREYHOUND COMPUTER	2- 3	2 5/8	0	0.0
N	ITEL	3- 9	6 1/4	- 1/8	-1.9
N	LEASCO CORP	4- 8	5 1/4	- 3/8	-6.6
O	LEASPAC CORP	1- 1	1/8	- 1/8	-50.0
O	LECTRO MGT INC	1- 1	1/8	0	0.0
O	NRG INC	0- 4	3/8	- 1/8	-25.0
A	PIONEER TEX CORP	2- 7	5 3/8	+ 1/8	+2.3
A	ROCKWOOD COMPUTER	1- 1	1/8	0	0.0
N	U.S. LEASING	7- 14	7 3/8	- 5/8	-7.8

EXCH: N=NEW YORK; A=AMERICAN; P=PHIL-BALT-WASH
L=NATIONAL; M=MIDWEST; O=OVER-THE-COUNTER
O-T-C PRICES ARE BID PRICES AS OF 3 P.M. OR LAST BID
(1) TO NEAREST DOLLAR

SOFTWARE & EDP SERVICES

EXCH		PRICE 1975 RANGE (1)	CLOSE NOV 19 1975	WEEK NET CHNGE	WEEK PCT CHNGE
O	ADVANCED COMP TECH	1- 1	1 1/8	+ 1/8	+12.5
A	APPLIED DATA RES.	1- 10	2	+ 3/4	+60.0
N	AUTOMATIC DATA PROC	29- 65	59	- 1/4	-0.4
O	BRANDON APPLIED SYST	1- 1	1/4	0	0.0
O	COMPUTER DIMENSIONS	2- 6	3 1/2	0	0.0
O	COMP ELECTION SYSTMS	3- 7	5 3/4	-1	-14.8
O	COMPUTER HORIZONS	1- 1	5/8	0	0.0
O	COMPUTER NETWORK	1- 3	2 3/4	- 3/8	-12.0
N	COMPUTER SCIENCES	2- 6	4 1/4	- 1/4	-5.5
O	COMPUTER TASK GROUP	1- 1	5/8	0	0.0
O	COMPUTER USAGE	2- 4	2 1/4	- 1/8	-5.2
O	COMSHARE	3- 4	3 1/8	0	0.0
O	DATATAB	1- 2	7/8	+ 1/8	+16.6
A	ELECT COMP PROG	1- 1	1/8	0	0.0
N	ELECTRONIC DATA SYS.	12- 28	12 3/8	- 7/8	-6.6
O	INFONATIONAL INC	1- 1	1/8	0	0.0
O	IPS COMPUTER MARKET.	1- 1	5/8	0	0.0
O	KEANE ASSOCIATES	2- 3	2 1/2	0	0.0
O	KEYDATA CORP	2- 3	2 7/8	+ 3/4	+35.2
O	LOGICON	3- 5	3 3/8	0	0.0
A	MANAGEMENT DATA	1- 3	1 3/4	+ 1/8	+7.6
A	NATIONAL CSS INC	6- 14	10 3/4	+ 3/8	+3.6
O	NATIONAL COMPUTER CO	1- 1	1/8	0	0.0
A	ON LINE SYSTEMS INC	8- 17	13 1/2	-1	-6.8
N	PLANNING RESEARCH	2- 6	3	- 3/8	-11.1
O	PROGRAMMING & SYS	1- 1	5/8	0	0.0
O	RAPIDATA INC	2- 5	4 5/8	+1 1/4	+37.0
O	REYNOLDS & REYNOLD	10- 24	13 3/4	-3 1/4	-19.1
O	SCIENTIFIC COMPUTERS	1- 1	1	0	0.0
O	SIMPLICITY COMPUTER	1- 1	1 1/4	+ 1/8	+11.1
O	TYMSHARE INC	7- 21	20 1/8	+ 1/2	+2.5
A	URS SYSTEMS	2- 4	3	- 1/8	-4.0
N	WYLY CORP	2- 4	3	0	0.0

PERIPHERALS & SUBSYSTEMS

EXCH		PRICE 1975 RANGE (1)	CLOSE NOV 19 1975	WEEK NET CHNGE	WEEK PCT CHNGE
N	ADDRESSOGRAPH-MULT	4- 9	8 3/8	+ 1/2	+6.3
O	ADVANCED MEMORY SYS	1- 7	4 3/8	- 1/2	-10.2
N	AMPEX CORP	3- 7	5 1/4	- 1/2	-8.6
O	ANDERSON JACOBSON	1- 3	1 7/8	- 1/4	-11.7
O	BEEHIVE MEDICAL ELEC	1- 5	3	0	0.0
A	BOLT,BERANEK & NEW	5- 13	7 3/8	- 3/4	-9.2
N	BUNKER-RAMO	4- 8	3 3/4	- 1/4	-6.2
A	CALCOMP	4- 7	3 1/2	- 1/8	-3.4
O	CAMBRIDGE MEMORIES	2- 5	1 5/8	- 1/4	-13.3
N	CENTRONICS DATA COMP	7- 25	19 3/8	+1 1/4	+6.8
O	CODEX CORP	15- 38	37 1/4	+ 1/2	+1.3
O	COGNITRONICS	1- 2	7/8	+ 1/8	+16.6
O	COMPUTER COMMUN.	1- 2	7/8	0	0.0
O	COMPUTER CONSOLES	3- 7	3 3/4	0	0.0
A	COMPUTER EQUIPMENT	1- 2	1 3/8	- 1/8	-8.3
O	COMPUTER MACHINERY	1- 2	3/4	- 1/8	-14.2
O	COMPUTER TRANSCEIVER	1- 2	7/8	0	0.0
O	COMTEN	2- 5	3 3/4	+ 1/2	+15.3
N	CONRAC CORP	12- 29	29 1/4	+4 1/2	+18.1
O	DATA ACCESS SYSTEMS	1- 3	1 3/4	0	0.0
O	DATA 100	5- 16	10 1/8	+ 1/4	+2.5
A	DATA PRODUCTS CORP	2- 6	4 1/4	+ 1/8	+3.0
O	DATA TECHNOLOGY	1- 3	1 3/8	+ 1/4	+22.2
O	DATUM INC	1- 2	7/8	0	0.0
O	DECISION DATA COMPUT	3- 7	2 3/4	- 1/8	-4.3
O	DELTA DATA SYSTEMS	1- 1	1/4	0	0.0
O	DI/AN CONTROLS	1- 1	3/4	0	0.0
N	ELECTRONIC M & M	1- 3	1 1/4	0	0.0
O	FABRI-TEK	1- 1	5/8	- 1/8	-16.6
O	GENERAL COMPUTER SYS	1- 2	1	0	0.0
N	HAZELTINE CORP	3- 6	3 1/2	0	0.0
N	HARRIS CORP	18- 32	31 1/4	- 3/4	-2.3
A	INCOTERM CORP	3- 12	7 3/4	-1 3/8	-15.0
O	INFOREX INC	2- 5	3	- 1/8	-4.0
O	INFORMATION INTL INC	8- 14	12	- 1/2	-4.0
A	LUNDY ELECTRONICS	3- 6	5 1/8	- 7/8	-14.5
O	MANAGEMENT ASSIST	1- 1	1/2	+ 1/8	+33.3
A	MILGO ELECTRONICS	8- 24	16 5/8	- 3/8	-2.2
N	MOHAWK DATA SCI	1- 5	2 7/8	- 1/4	-8.0
O	OPTICAL SCANNING	1- 3	2 5/8	0	0.0
O	PENRIL CORP	2- 2	3/4	- 1/2	-40.0
O	PERTEC CORP	2- 8	4	0	0.0
A	POTTER INSTRUMENT	2- 2	1 3/4	0	0.0
O	PRECISION INST.	1- 1	1/2	+ 1/8	+33.3
O	QUANTOR CORP	2- 6	4	- 3/4	-15.7
O	RECOGNITION EQUIP	2- 9	6 1/8	- 1/4	-3.9
N	SANDERS ASSOCIATES	3- 11	7 1/8	- 3/4	-9.5
O	SCAN DATA	1- 3	1 1/4	- 1/8	-9.0
O	STORAGE TECHNOLOGY	6- 17	10 3/4	- 3/4	-6.5
O	SYCOR INC	5- 22	20	-2 1/4	-10.1
O	T BAR INC	3- 6	6 1/4	0	0.0
O	TALLY CORP.	1- 5	2 3/8	0	0.0
O	TEC INC	1- 4	2	- 1/2	-20.0
N	TEKTRONIX INC	18- 43	42 5/8	+ 1/8	+0.2
N	TELEX	1- 3	2	- 1/8	-5.8
O	WANGCO INC	4- 9	7 3/8	+ 1/2	+7.2
O	WILTEK INC	1- 4	2 1/2	0	0.0

SUPPLIES & ACCESSORIES

EXCH		PRICE 1975 RANGE (1)	CLOSE NOV 19 1975	WEEK NET CHNGE	WEEK PCT CHNGE
O	BALTIMORE BUS FORMS	4- 5	4 1/2	+ 1/4	+5.8
A	BARRY WRIGHT	5- 7	5 3/8	- 3/8	-6.5
O	CYBERMATICS INC	0- 1	3/8	0	0.0
A	DATA DOCUMENTS	29- 42	32 3/4	+ 1/2	+1.5
O	DUPLEX PRODUCTS INC	12- 25	16	-1 3/8	-7.9
N	ENNIS BUS. FORMS	5- 7	5 3/4	+ 3/8	+6.9
O	GRAHAM MAGNETICS	5- 10	10	+1	+11.1
O	GRAPHIC CONTROLS	8- 21	13	- 1/4	-1.8
N	3M COMPANY	43- 68	60 1/4	+ 1/8	+0.2
O	MOORE CORP LTD	39- 51	48 1/4	+ 1/2	+1.0
N	NASHUA CORP	9- 22	10 1/2	- 3/8	-3.4
O	STANDARD REGISTER	11- 20	16 1/4	+ 1/2	+3.1
O	TAB PRODUCTS CO	4- 8	4 3/4	- 1/4	-5.0
N	UARCO	17- 24	21 3/8	+ 1/4	+1.1
O	VANIER GRAPHICS CORP	4- 7	4 3/4	+ 1/4	+5.5
A	WABASH MAGNETICS	3- 5	3 7/8	0	0.0
N	WALLACE BUS FORMS	15- 25	17 5/8	+ 5/8	+3.6

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